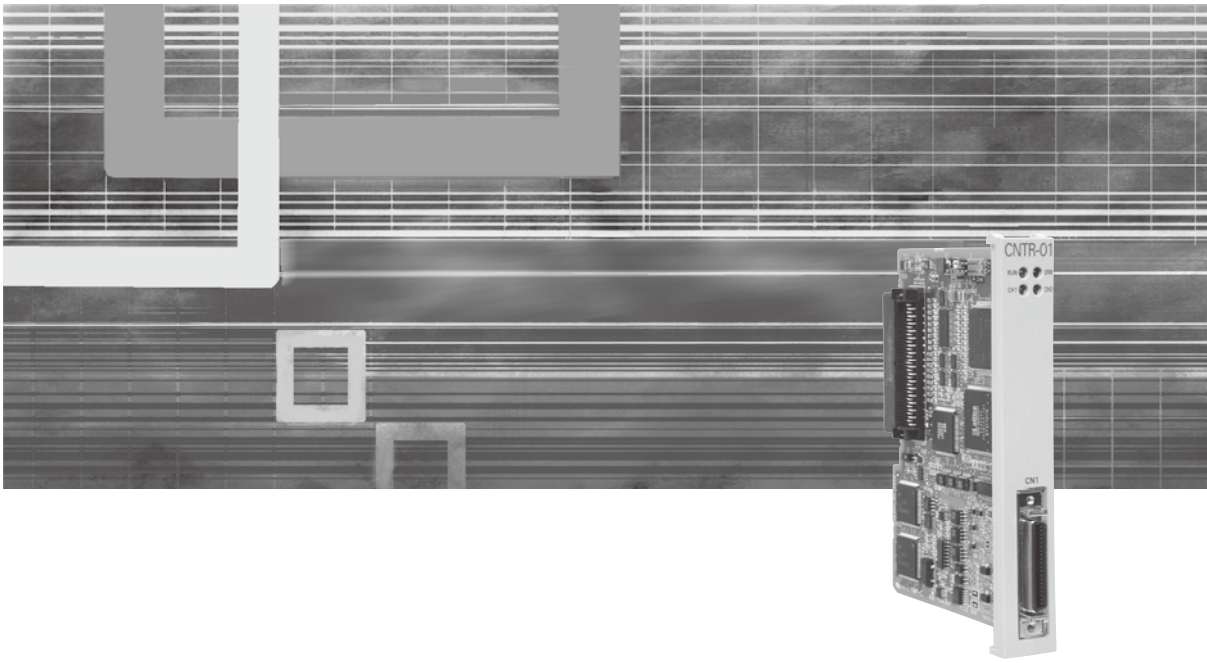
Machine Controller MP2000 Series

Counter Module

CNTR-01 USER'S MANUAL

Model: JAPMC-PL2300-E



YASKAWA

MANUAL NO. SIEP C880700 27A

Using this Manual

CNTR-01 indicates the counter module for the MP2000 series Machine Controller.
Please read this manual to ensure correct usage of the CNTR-01. Keep this manual in a safe place for future reference.

■ Graphic Symbols Used in this Manual

The graphic symbols used in this manual indicate the following type of information.

- This symbol is used to indicate important information that should be memorized or minor precautions, such as precautions that will result in alarms if not heeded.

■ Indication of Reverse Signals

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

Notation Examples

- $\overline{\text{S-ON}}$ = /S-ON
- $\overline{\text{P-CON}}$ = /P-CON

■ Copyrights

- Microsoft, Windows, Windows NT, and Internet Explorer are registered trademarks of the Microsoft Corporation.
- Pentium is a registered trademark of the Intel Corporation.
- Other product names and company names are the trademarks or registered trademarks of the respective company. “TM” and the ® mark do not appear with product or company names in this manual.

■ Related Manuals

Refer to the following related manuals as required.

Thoroughly check the specifications, restrictions, and other conditions of the product before attempting to use it.

Manual Name	Manual Number	Contents
Machine Controller MP2300 Communication Module User's Manual	SIEPC88070004□	Describes the functions, specifications, and application methods of the MP2300 Communication Modules (217IF, 218IF, 260IF, 261IF).
Machine Controller MP900 Series User's Manual Ladder Programming	SIEZ-C887-1.2□	Describes the instructions used in MP900/MP2000 ladder programming.
Machine Controller MP□□ User's Manual Motion Programming	SIEZ-C887-1.3□	Describes the instructions used in MP900/MP2000 motion programming.
Machine Controller MP900/MP2000 Series MPE720 Software for Programming Device User's Manual	SIEPC88070005□	Describes how to install and operate the MP900/MP2000 Series programming system (MPE720).
Σ Series SGM□/SGD User's Manual	SIE-S800-26.3□	Describes the Σ Series SERVOPACK models, specifications and capacity selection methods.
Σ Series SGM□/SGDB User's Manual	SIE-S800-26.4□	Describes the Σ Series SERVOPACK models, specifications and capacity selection methods.
Σ-II Series SGM□H/SGDM User's Manual	SIEPS80000005□	Describes the installation, wiring, trial operation, function applications methods, maintenance, and inspection of the Σ-II Series SERVOPACKs.
Σ-II Series SGM□H/SGDM User's Manual	SIEPS80000015□	Describes the installation, wiring, trial operation, function applications methods, maintenance, and inspection of the Σ-II Series SERVOPACKs.
Σ-III Series SGM□S/SGDS User's Manual	SIEPS80000000□	Describes the models, capacities, selection methods, ratings, characteristics, diagrams, cables, peripheral devices, wiring, panel installation, trial operation, adjustment, function application methods, maintenance, and inspection of the Σ-III Series SERVOPACKs and Servomotors.
Σ-III Series SGM□S/SGDS Digital Operator Instructions	TOBPS80000001□	Describes the operation methods of the JUSP-OP05A Digital Operator.
Σ-III Series SGM□S/SGDS User's Manual For MECHATROLINK-II communications	SIEPS80000011□	Describes the models, capacities, selection methods, ratings, characteristics, diagrams, cables, peripheral devices, wiring, panel installation, trial operation, adjustment, function application methods, maintenance, inspection, and MECHATROLINK communication of the ∑-III Series SERVOPACKs and Servomotors.
Machine Controller MP900/MP2000 Series Linear Servomotor Manual	SIEPC88070006□	Describes the connection methods, setting methods, and other information for Linear Servomotors.
Machine Controller MP900 Series New Ladder Editor Programming Manual	SIE-C887-13.1□	Describes the programming instructions of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.
Machine Controller MP900 Series New Ladder Editor User's Manual	SIE-C887-13.2□	Describes the operating methods of the New Ladder Editor, which assists MP900/MP2000 Series design and maintenance.
Machine Controller MP900/MP2000 Series User's Manual MECHATROLINK System	SIEZ-C887-5.1□	Describes the distributed I/O Module for the MECHATROLINK Modules for MP900/MP2000 Series Machine Controllers.

Safety Information

The following conventions are used to indicate precautions in this manual. These precautions are provided to ensure the safe operation of the MP2000 series and connected devices. Information marked as shown below is important for the safety of the user. Always read this information and heed the precautions that are provided.
The conventions are as follows:

⚠ WARNING

Indicates precautions that, if not heeded, could possibly result in loss of life, serious injury, or property damage.

⚠ CAUTION

Indicates precautions that, if not heeded, could result in relatively serious or minor injury, or property damage.

If not heeded, even precautions classified under ⚠ CAUTION can lead to serious results depending on circumstances.

PROHIBITED

Indicates prohibited actions. Specific prohibitions are indicated inside ⃠ .

For example,  indicates prohibition of open flame.

MANDATORY

Indicates mandatory actions. Specific actions are indicated inside ● .

For example,  indicates mandatory grounding.

Safety Precautions

The following precautions are for checking products on delivery, storage, transportation, installation, wiring, operation, maintenance, inspection, and disposal. These precautions are important and must be observed.

⚠ WARNING

- Before starting operation in combination with the machine, ensure that an emergency stop procedure has been provided and is working correctly.
  There is a risk of injury.
- Do not touch anything inside the MP2000 series.
  There is a risk of electrical shock.
- Always keep the front cover attached when power is being supplied.
  There is a risk of electrical shock.
- Observe all procedures and precautions given in this manual for trial operation.
  Operating mistakes while the servomotor and machine are connected can cause damage to the machine or even accidents resulting in injury or death.
- Do not remove the module, front cover, cables, connector while power is being supplied.
  There is a risk of electrical shock.
- Do not damage, pull on, apply excessive force to, place heavy objects on, or pinch cables.
  There is a risk of electrical shock, operational failure or burning of the MP2000 series.
- Do not attempt to modify the MP2000 series in any way.
  There is a risk of injury or device damage.
- Do not approach the machine when there is a momentary interruption to the power supply. When power is restored, the machine controller and the connecting devices may start operation suddenly. Provide suitable safety measures to protect people when operation restarts.
  There is a risk of injury.
- Do not allow installation, disassembly, or repairs to be performed by anyone other than specified personnel.
  There is a risk of electrical shock or injury.

■ Storage and Transportation

⚠ CAUTION

- Do not store or install the MP2000 series in the following locations.
  - Direct sunlight
  - Ambient temperature exceeds the storage or operating conditions
  - Ambient humidity exceeds the storage or operating conditions
  - Rapid changes in temperature or locations subject to condensation
  - Corrosive or flammable gas
  - Excessive dust, dirt, salt, or metallic powder
  - Water, oil, or chemicals
  - Vibration or shock
- Do not subject the MP2000 series to halogen gases, such as fiuorine, chlovine, bromine, and iodine, at any time even during transportation or installation.
  There is a risk of device damage or injury.
- Do not overload the MP2000 series during transportation.
  There is a risk of injury or an accident.

■ Installation

⚠ CAUTION

- Never use the MP2000 series in locations subject to water, corrosive atmospheres, or flammable gas, or near burnable objects.
  There is a risk of electrical shock or fire.
- Do not step on the MP2000 series or place heavy objects on the MP2000 series.
  There is a risk of injury.
- Do not allow foreign objects to enter the MP2000 series.
  There is a risk of element deterioration inside, an accident, or fire.
- Always mount the MP2000 series in the specified orientation.
  There is a risk of an accident.
- Do not subject the MP2000 series to strong shock.
  There is a risk of an accident.

■ Wiring

⚠ CAUTION

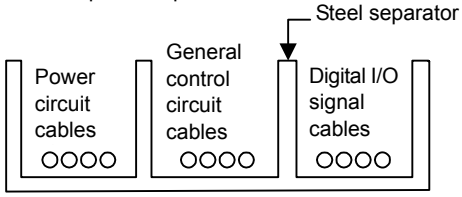
- Check the wiring to be sure it has been performed correctly.
  There is a risk of motor run-away, injury, or an accident.
- Always use a power supply of the specified voltage.
  There is a risk of burning.
- In places with poor power supply conditions, take all steps necessary to ensure that the input power supply is within the specified voltage range.
  There is a risk of device damage.
- Install breakers and other safety measure to provide protection against shorts in external wiring.
  There is a risk of fire.
- Provide sufficient shielding when using the MP2000 series in the following locations.
  There is a risk of device damage.
  - Noise, such as from static electricity
  - Strong electromagnetic or magnetic fields
  - Radiation
  - Near to power lines

■ Selecting, Separating, and Laying External Cables

⚠ CAUTION

- Consider the following items when selecting the I/O signal lines (external cables) to connect the MP2000 series to external devices.
  - Mechanical strength
  - Noise interference
  - Wiring distance
  - Signal voltage, etc.
- Separate the I/O signal lines from the power lines both inside and outside the control box to reduce the influence of noise from the power lines.
  If the I/O signal lines and power lines are not separated properly, malfunctioning may result.

Example of Separated External Cables



■ Maintenance and Inspection Precautions

⚠ CAUTION

- Do not attempt to disassemble the MP2000 series.
  There is a risk of electrical shock or injury.
- Do not change wiring while power is being supplied.
  There is a risk of electrical shock or injury.

■ Disposal Precautions

⚠ CAUTION

- Dispose of the MP2000 series as general industrial waste.

■ General Precautions

Observe the following general precautions to ensure safe application.

- The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual.
- The drawings presented in this manual are typical examples and may not match the product you received.
- If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.

Warranty

(1) Details of Warranty

■ Warranty Period

The warranty period for a product that was purchased (hereafter called “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

■ Warranty Scope

Yaskawa shall replace or repair a defective product free of change if a defect attributable to Yaskawa occurs during the warranty period above. This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.
This warranty does not cover failures that result from any of the following causes.

1. Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Abuse of the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

(2) Limitations of Liability

1. Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
2. Yaskawa shall not be responsible for any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
3. The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
4. Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

(3) Suitability for Use

1. It is the customer's responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
    - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
    - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
    - Systems, machines, and equipment that may present a risk to life or property
    - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
    - Other systems that require a similar high degree of safety
4. Never use the product for an application involving serious risk to life or property without first ensuring that the system is designed to secure the required level of safety with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
5. The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

(4) Specifications Change

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

CONTENTS

1

Mounting Optional Modules on Machine Controller

This chapter explains on the MP2000 series Machine Controller, that can install the CNTR-01 Module, and mounting/removing the optional modules.

1.1 CNTR-01 Module Applicable Machine Controllers

The table below lists the MP2000-series Machine Controllers on which the CNTR-01 Module can be mounted.

Name		Model	Max. Number of Connecttable Modules	Applicable CPU Version	Applicable MPE720 Version	Remarks
MP 2200	Base Unit with 100/ 200-VAC Input	JEPMC-BU2200	30 modules when using the CPU-01*1 31 modules when using the CPU-02*2	Ver. 2.44 or later	Ver. 5.33 or later	Max. Number of CNTR-01 Modules that Can Be Connected when using 4 racks (extended to the maximum)*3
	Base Unit with 24-VDC Input	JEPMC-BU2210				
MP2300		JEPMC-MP2300	2 modules			
MP2100M		JAPMC-MC2140	24 modules			Can be mounted on an expansion rack when mounting an expansion I/F board MP2100MEX (model: JAPMC-EX2200 and connecting an expansion rack (can be used als as the MP2200 base unit). Max. Number of CNTR-01 Modules that Can Be Connected when using 3 racks (extended to the maximum)*3

* 1. CPU Module for MP2200. Model: JAPMC-CP2200
* 2. CPU Module for MP2200. Model: JAPMC-CP2210, with one slot for CF card and one USB port
* 3. The Connection Module EXIOIF (Model: JAPMC-EX2200) is required between racks.

- CNTR-01 Module cannot be mounted on the following MP2000-series Machine Controllers: MP2100, MP2500, and MP2500M

1.2 Mounting/Removing Option Modules on Machine Controller

Use the following procedure to mount or remove Option Modules.

- In the photos given here to explain the procedure, a Machine Controller MP2200 and an Option Module 217IF-01 are used. The procedure to mount a Counter Module CNTR-01 on a Machine Controller MP2300 or MP2100M is the same as that to mount 217IF-01 on MP2200.

1.2.1 Mounting Option Modules

Use the followin procedure to mount an Option Module.

- For the replacement of Option Module, refer to *1.2.2 Removing Optional Modules* on page 17 to remove the Option Module to be replaced.

(1) Preparation

1. Backup the Programs

Save the programs written to the Machine Controller in the personal computer using MPE720. (Right-click the Counter Folder, and select ***Transfer - All Files - Dump*** from the pop-up menu.)

2. Remove the Machine Controller and Expansion Racks

a) For MP2300

Turn OFF the power supply and disconnect all the cables from the MP2300. Then, remove the MP2300 from the panel or rack, and place it where there is sufficient space, such as working table.

b) For MP2200 and MP2100M

Turn OFF the power supply and disconnect all the cables from the expansion rack (MP2200 base unit) where the Option Module to be replaced is mounted. Then, remove the expansion rack and place it on a place with sufficient space, such as working table.

(2) Removing Optional Cover

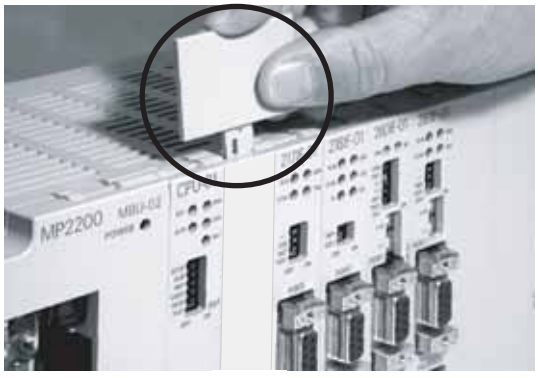
Use the following procedure if the optional cover is installed on the slot.

1. Remove the battery cover.

Pull the notch on the side of the MP2000 series towards you to remove the battery cover.

2. Remove the cover of Optional Module.

Insert the protruding part of the battery cover into the slot on top of the cover of Optional Module to unhook, as shown in the diagram. Face the front of the battery cover towards you for this operation.



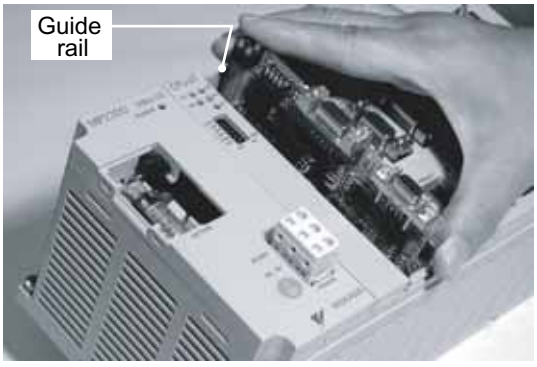
Unhook the bottom in the same way.

(3) Installing Optional Modules

1. Insert Optional Modules.

Guide rails are visible at the top and bottom of the Option Slot, as shown in the following diagram. Line up the Module with the guide rail and insert the Module straight.

- The FG bar on the inside bottom of the Unit Case may be damaged if the Module is inserted without following the guide rail.

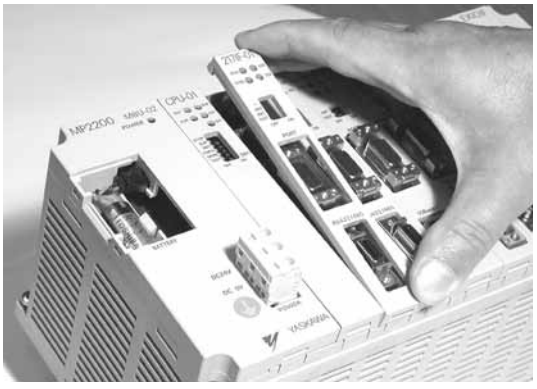


2. Mount on to the mounting base.

Once the Optional Module has been completely inserted, place your hand on the front face of the Optional Module and push hard until the Optional Module has been inserted into the mounting base connectors. The front face of the Optional Module and the hook will be aligned when the Optional Module has been installed properly.

3. Install the panel of the Optional Module.

Place the hole on the bottom of the panel of the Optional Module onto the hook on the bottom of the MP2300.



This completes the installation procedure.

1.2.2 Removing Optional Modules

(1) Preparation

1. Backup the Programs

Save the programs written to the Machine Controller in the personal computer using MPE720. (Right-click the Controller Folder, and select ***Transfer*** - ***All Files*** - ***Dump*** from the pop-up menu.)

2. Remove the Machine Controller and Expansion Racks

a) For MP2300

Turn OFF the power supply and disconnect all the cables from the MP2300. Then, remove the MP2300 from the panel or rack, and place it on a place with sufficient space, such as working table.

b) For MP2200 and MP2100M

Turn OFF the power supply and disconnect all the cables from the expansion rack (MP2200 base unit) where the Option Module to be replaced is mounted. Then remove the expansion rack and place it in a place with sufficient space, such as working table.

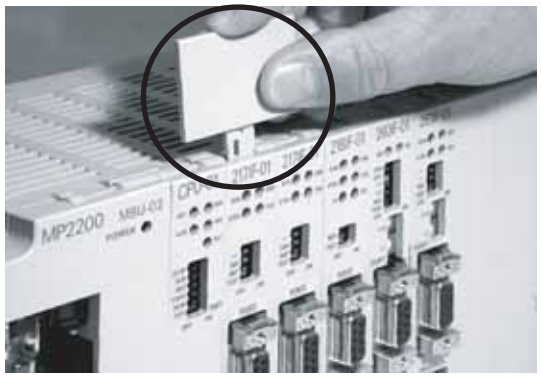
(2) Removing Optional Modules

1. Remove the battery cover.

Pull the notch on the side of the MP2000 series towards you to remove the battery cover.

2. Remove the panel of Optional Module.

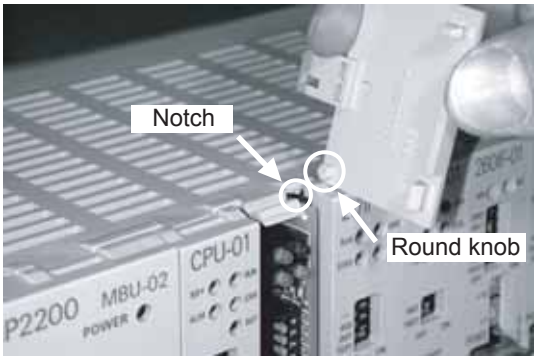
Insert the protruding part of the battery cover into the slot on top of the panel of Optional Module to unhook, as shown in the diagram. Face the front of the battery cover towards you for this operation.



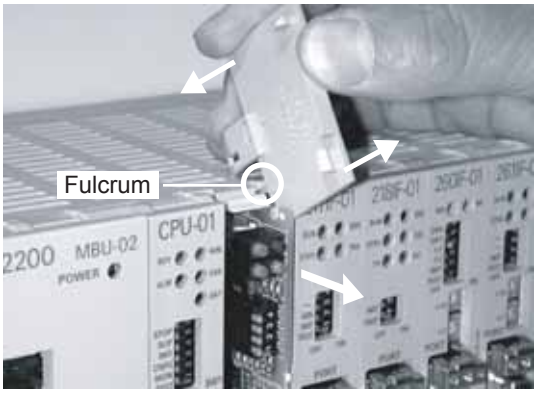
Unhook the bottom in the same way.

3. Remove the Optional Module from the mounting base.

Pull the top of the panel of the Optional Module towards you to remove it. A notch on the Optional Module will be visible from the gap in the cover. Hook the round knob on the battery cover, shown in the diagram, into the notch in the Optional Module.

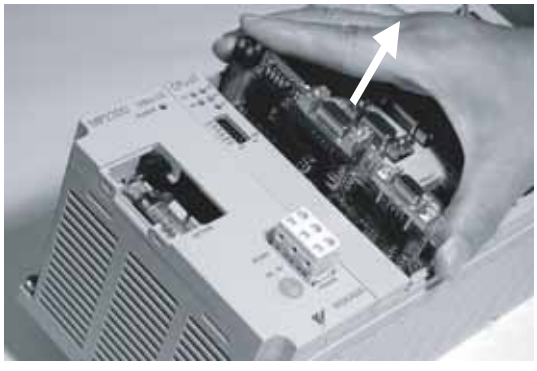


Hold the center of the battery cover as shown in the following diagram. Push the battery cover down and out, rotating from the round knob to disconnect the Module and mounting base connectors, and then pull the Optional Module forward.



4. Pull out the Optional Module.

Hold the Module on the top and bottom and pull it out straight. Hold the edges of the Module and avoid touching the parts on the Module.



Put the removed Module into the bag that it was supplied with and store it in this bag.

- The optional cover must be installed on the empty slot.

2

Specifications and Functions for CNTR-01 Module

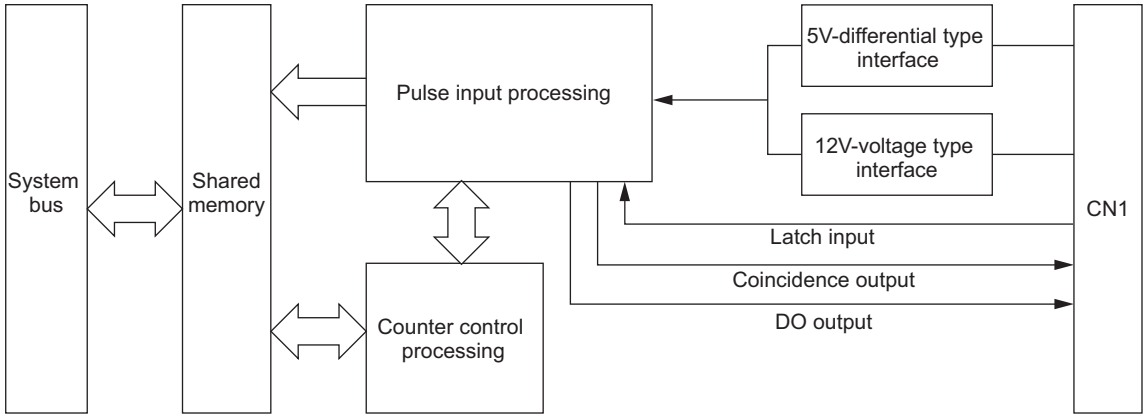
This chapter explains the detailed specifications and functions of the CNTR-01 Module.

2.1 CNTR-01 Module Specifications

This section explains the function, appearance, and specifications of CNTR-01 module.

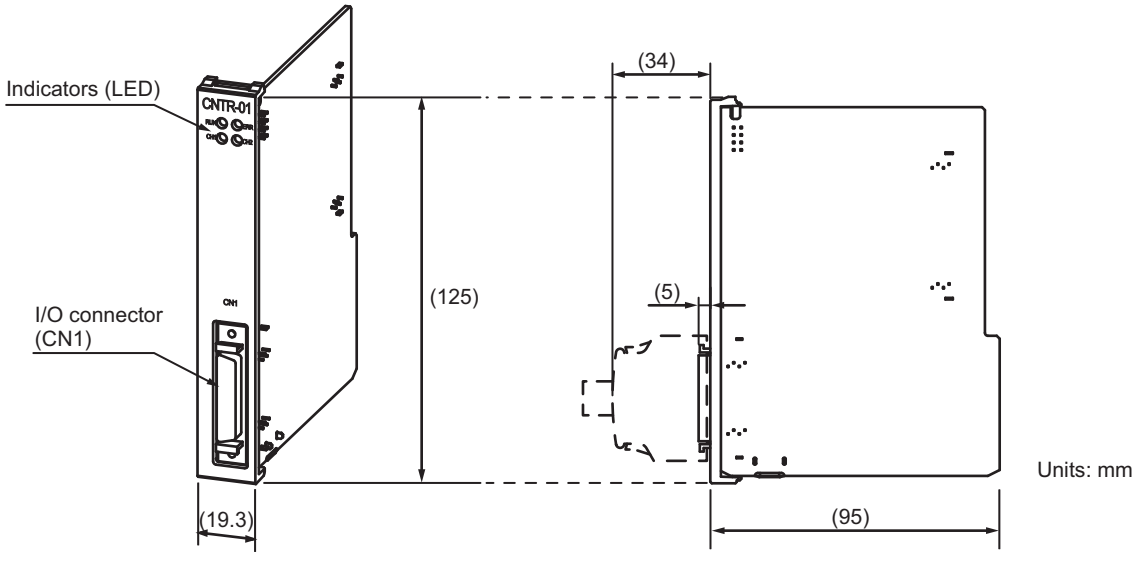
2.1.1 CNTR-01 Module Functions

The CNTR-01 module is equipped with 32 bits and 2 channels, and counts the pulse outputs of the pulse generator such as rotary encoder.
CNTR-01 module can be mounted to the MP2300 option slot with up to 2 modules, and to the MP2200 base unit (when 4 units are connected) with up to 30 modules (when CPU-01 is used) or 31 modules (when CPU-02 is used), and to the MP2100M and MP2100MEX expansion lack (when 3 lacks are connected) with 24 modules.



2.1.2 CNTR-01 Module Appearance and External Dimensions

The following diagram shows the appearance of the CNTR-01, and the external dimensions when connecting the cable connector.



CNTR-01 Module Appearance

External Dimensions when installing the cable connector (side view)

2.1.3 Specifications

The following table shows the general and hardware specifications, and the details of LED of the CNTR-01 module.

(1) General Specifications

Item		Specifications
Environmental Conditions	Ambient Operating Temperature	0 to 55 °C
	Ambient Storage Temperature	-25 to 85 °C
	Ambient Operating Humidity	30% to 95% (with no condensation)
	Ambient Storage Humidity	5% to 95% (with no condensation)
	Pollution Level	Pollution level 1 (conforming to JIS B 3501)
	Corrosive Gas	There must be no combustible or corrosive gas.
	Operating Altitude	2,000 m above sea level or lower
Mechanical Operating Conditions	Vibration Resistance	Conforming to JIS B 3502: 10 to 57 Hz with single-amplitude of 0.075 mm 57 to 150 Hz with fixed acceleration of 9.8 m/s^2 10 sweeps each in X, Y, and Z directions (sweep time: 1 octave/min)
	Shock Resistance	Conforming to JIS B 3502: Peak acceleration of 147 m/s^2 (15 G) twice for 11 ms each in the X, Y, and Z directions
Electrical Operating Conditions	Noise Resistance	Conforming to EN 61000-6-2, EN 55011 (Group 1, Class A) Power supply noise (FT noise): 2 Kv min., for one minute Radiation noise (FT noise): 1 Kv min., for one minute
Installation Requirements	Ground	Ground to 100 Ω max.
	Cooling Method	Natural cooling

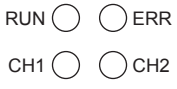
(2) Hardware Specifications

Item	Specifications
Description	Counter Module
Name	CNTR-01
Model Number	JAPMC-PL2300-E
Number of Channels	2
Input Circuits (Can be switched using the MPE720)	5-V differential: Max. frequency 4 MHz (RS422, non-isolated) 12V: Max. frequency 120 KHz (12 V, 7 mA current source mode input, photocoupler I/F)
Pulse Counting Methods (Can be switched using the MPE720)	A/B (×1, ×2, and ×4) Up/Down （×1 and ×2) Sign （×1 and ×2)
Counter Function (Can be switched using the MPE720)	Reversible counter mode Interval counter mode Frequency measurement mode
Coincidence Interrupt	Outputs to the CPU Module via the system bus. Simultaneously outputs a DO.

Item	Specifications
Coincidence Output	2-point 24-VDC ± 20%, 50 mA current sink mode output, photocoupler interface Response time: 1ms max. when OFF → ON, 1ms max. when ON → OFF
DO Output * (Can be switched using the MPE720)	2-point 24-VDC ± 20% , 50 mA current sink mode output, photocoupler interface Response time: 1 ms max. when OFF → ON, 1 ms max. when ON → OFF ・Zone output ・Speed coincidence ・Frequency coincidence
PI Latch Output	DI: 2-point 24-VDC ± 20% souce mode input, photocoupler I/F Response time: 30 μs max. when OFF → ON, 600 μs max. when ON → OFF Phase-C: In 5-V differential input mode, the minimum ON pulse width is 125 ns. In 12/24-V input mode, the minimum ON pulse width is 4.2 μs. Latch input response time: 95 to 125 ns (response delay for pulse-A or B input
Connector	CN1: I/O connector
Indicators	RUN (green) ERR (red) CH1 (green) CH2 (green)
Current Consumption	600mA at 5 V
Dimensions (mm)	125 × 95 (H × D)
Mass	Approx. 85 g

* Note that the DO output may turn ON at the moment the power supply turns OFF for 3 or 4 ms.

(3) LED Indicators



Name	Color	Status when Lit	Status when Unlit
RUN	Green	Normally operating	Being stopped
ERR	Red	Malfunction occurs	Normally operating
CH1	Green	CH1 counter count value increments or decrements	No pulse input
CH2	Green	CH2 counter count value increments or decrements	No pulse input

(4) CNTR-01 Module Status Indication

The CNTR-01 Module status is indicated by the combination of LED indicators as shown in the following table.

Status	Indication				CNTR-01 Module Status	Description
	RUN	ERR	CH1	CH2		
Initialization	○	●	○	○	Status when power is turned ON	This is the status just after the Module's power supply is turned ON. The ERR Indicator is turned OFF during initialization. A boot error occurred if this LED status does not change. The CNTR-01 firmware must be overwritten if a boot error occurs.
Normal Operation Status	○	○	○	○	Not defined	Indicates that the CNTR-01 Module has not been registered in Module Configuration. Register the Module in the Module Configuration Window.
	★	○	–	–	CPU being stopped	Indicates that the Machine Controller's CPU is being stopped. Execute a CPU RUN command to restore normal operation status.
	●	○	–	–	Operating normally	The Module is operating normally and pulse count is being performed.

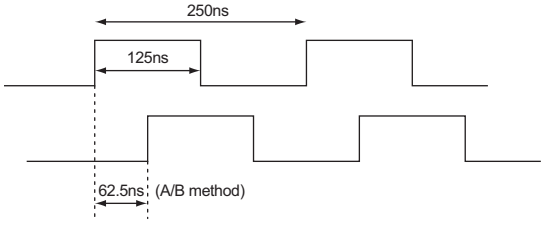
Status	Indication				CNTR-01 Module Status	Description
	RUN	ERR	CH1	CH2		
Error	★	★	–	–	Hardware error 1: - 2: ROM error 3: RAM error 4: CPU error 6: Shared memory error 7: Counter ASIC error (Number indicates the number of times blinking.)	Hardware failure of the CNTR-01 Module occurred. Replace the Module.
	○	★	–		Software error 1: - 2: Watchdog time timeout error 3: Address error (reading) exception 4: Address error (writing) exception 6: General illegal instruction exception 7: Slot illegal instruction exception (Number indicates the number of times blinking.)	Software failure of the CNTR-01 Module occurred. Replace the Module.

● : Lit
○ : Unlit
★ : Blinking
- : Not specified

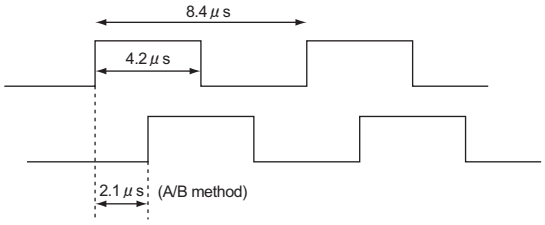
(5) Minimum Width of Pulse Counting

Fill the following pulse width with the loose wire side of the standard cable (JEPMC-W2063-□□-E).

■ Input 5-V Differential Input



■ Input 12V



2.2 Pulse Counting Methods

The CNTR-01 Module supports three pulse counting methods:

- Sign
- UP/DOWN
- A/B

This section describes the details on each pulse counting method.

2.2.1 Sign Method

The count is incremented and decremended based on the polarity:

Polarity: Positive logic

When the pulse B input is at Low, the count is incremented by the pulse A input. (Positive in the frequency measurement*)

When the pulse B input is at High, the count is decremented by the pulse A input. (Negative in the frequency measurement)

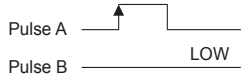
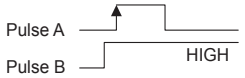
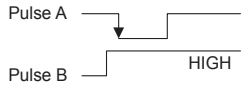
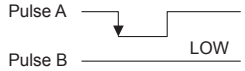
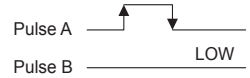
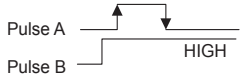
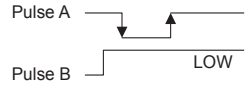
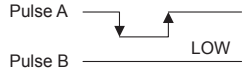
Polarity: Negative logic

When the pulse B input is at High, the count is incremented by the pulse A input. (Positive in the frequency measurement).

When the pulse B input is at Low, the count is decremented by the pulse A input. (Negative in the frequency measurement)

* For information on the frequency measurement, refer to *2.3.3 Frequency Measurement Counter* on page 28.

The following table shows the pulse counting operations with different multiplications and polarities.

Pulse Counting Method	Polarity	UP Count (Forward)	DOWN Count (Reverse)
Sign (×1)	Positive logic		
	Negative logic		
Sign (×2)	Positive logic		
	Negative logic		

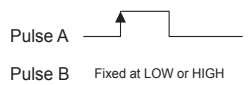
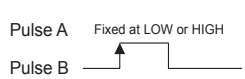
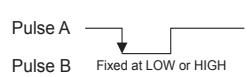
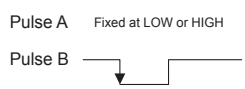
2.2.2 UP/DOWN Method

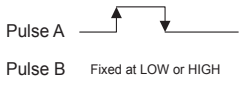
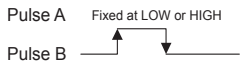
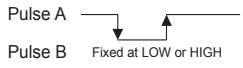
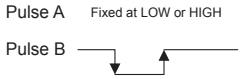
The count is incremented ane decremented in the following way regardless of the polarity.

The count is incremented by the pulse A input. (Positive in the frequency measurement*)

The count is decremented by the pulse B input. (Negative in the frequency measurement)

The following table shows the pulse counting operations with different multiplications and polarities.

Pulse Counting Mode	Polarity	UP Count (Forward)	DOWN Count (Reverse)
UP/DOWN (×1)	Positive logic		
	Negative logic		

Pulse Counting Mode	Polarity	UP Count (Forward)	DOWN Count (Reverse)
UP/DOWN (×2)	Positive logic		
	Negative logic		

- ±0 when the pulses A and B are input at a time.

2.2.3 Pulse A/B Method

The count is incremented and decremented based on the polarity as explained below.

Polarity: Positive logic

The count is incremented when the phase of the pulse A input is advanced from the pulse B. (Positive in the frequency measurement)

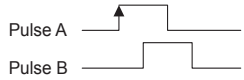
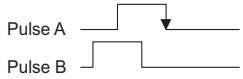
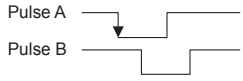
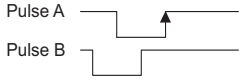
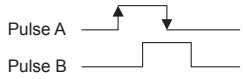
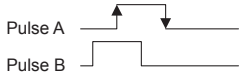
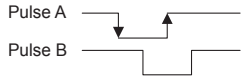
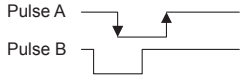
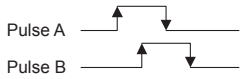
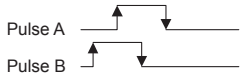
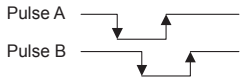
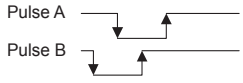
The count is decrmented when the phase of the pulse A input is lagged behind the pulse B. (Negative in the frequency measurement)

Polarity: Negative logic

The count is incremented when the phase of the pulse A input is advanced from the pulse B 0. (Positive in the frequency measurement)

The count is decremented when the phase of the pulse A input is lagged behing the pulse B 0. (Negative in the frequency measurement)

The following table shows the pulse counting operations with difference multiplications and polatiries.

Pulse Counting Mode	Polarity	UP Count (Forward)	DOWN Count (Reverse)
A/B (×1)	Positive logic		
	Negative logic		
A/B (×2)	Positive logic		
	Negative logic		
A/B (×4)	Positive logic		
	Negative logic		

2.3 Counter Modes

The CNTR-01 Module has three counter modes. The counter mode can be switched by setting the Fixed Parameter Tab Page* of CNTR-01 Module Definition Window.

- Reversible counter
- Interval counter
- Frquency measurement

This section outlines each counter mode.

* Refer to *2.4.2 Setting the Counter Fixed Parameters* on page 30.

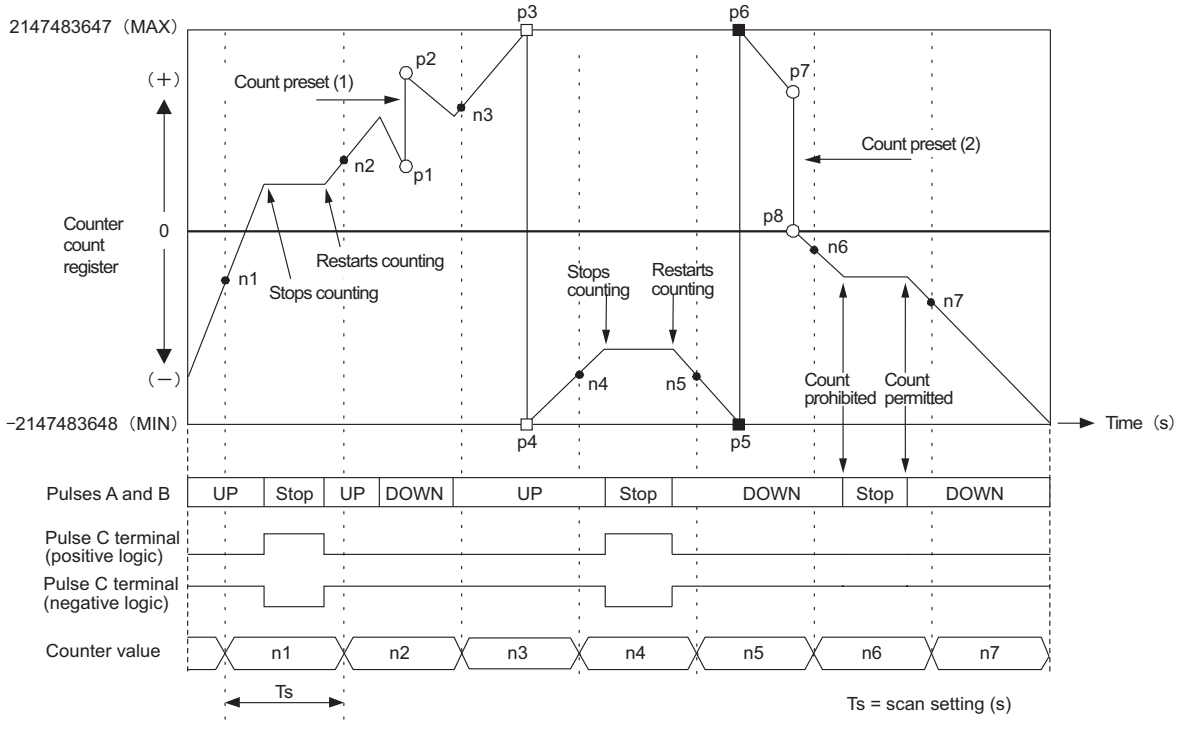
2.3.1 Reversible Counter

The count is incremented and decremented based on the pulse A and pulse B inputs.

The Count Disable and Count Preset functions are enabled when specified in the output data setting field* of I/O Data Tab Page in the CNTR-01 Module Definition Window. Also the Mask of Calculation by C-Pulse can be selected to prohibit counting while the pulse C is being input. The count value is stored in the input register (Counter Value) every high-speed scan (or low-speed scan).

* Refer to *2.4.3 (3) Out Data Items* on page 35.

The diagram below illustrates an example of the reversible counter operation when the Counting Mask Using Pulse C function is enabled)..



<Explanation>

Counter value (IL□□□□+4)

Stores sequentially the count value every scan (n1 to n7 in the above diagram)

Count preset (1) and (2)

As the Count Preset Request is executed at the positions p1 and p7 in the above diagram, the count values are forcibly reset to the preset values p2 and p8.

Overflow and Underflow

When the count value increments to the value MAX (p3), it is automatically reset to the value MIN (p4)
When the count value decrements to the value MIN (p5), it is automatically reset to the value MAX (p6).

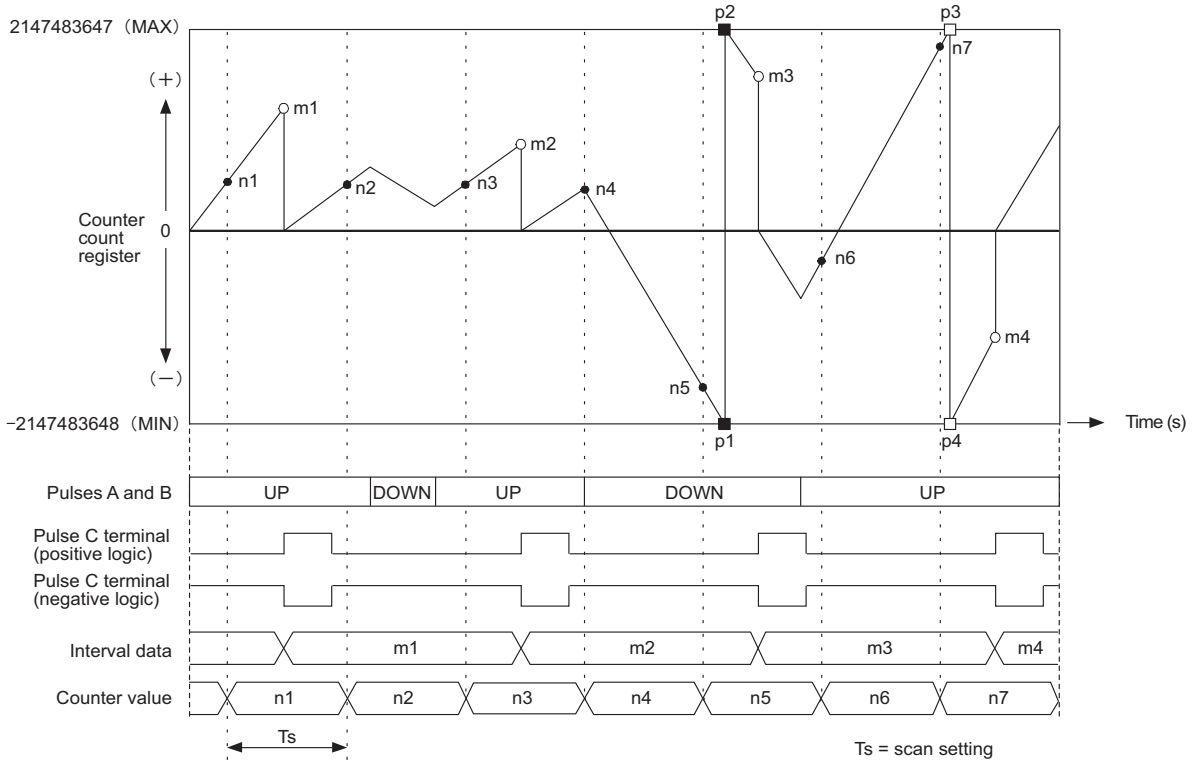
Count disable/Count permit

The Counting Mask Using Pulse C function is enabled to stop counting while the pulse C is being input. Also, executing the Count Prohibit command stops counting until the command is cancelled regardless of the pulse C input.

2.3.2 Interval Counter

The count is incremented and decremented based on the pulse A and B inputs, and the count value is stored in the input register (Current Counter Count Value) every high-speed scan (or low-speed scan).
The count value is latched and the counter is reset when the pulse C is input (Inverval Latch). The latched data is stored in the input register (Interval Data) every set scan.

The diagram below illustrates an example of the interval counter operation.



<Explanation>

Counter value (IL□□□□+4)

Stores sequentially the count value (n1 to n7 in the above diagram) every scan.

Interval data (IL□□□□+6)

The count value (m1 to m4 in the above diagram) is latched and reset at the rising edge of the pulse C. The latched data is stored in the register Interval Data (IL□□□□+6).

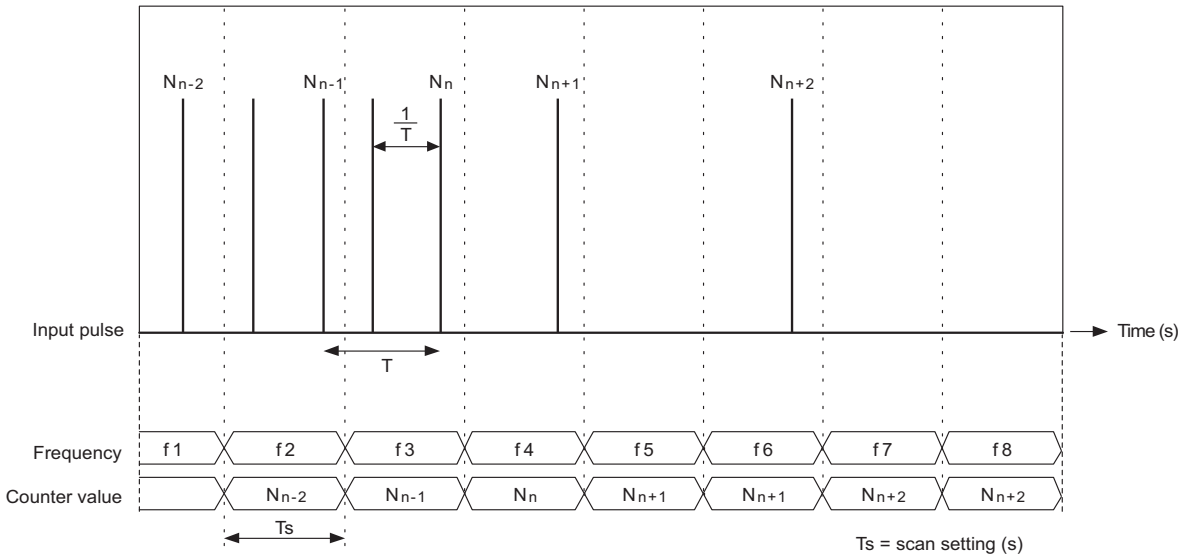
Overflow and Underflow

When the count value decrements to the value MIN (p1), it is automatically reset to the value MAX (p2).
When the count value increments to the value MAX (p3), it is automatically reset to the value MIN (p4).

2.3.3 Frequency Measurement Counter

The frequency is calculated from the input pulse A and B trains and stored in the input register (Counter Value) every high-speed scan (or low-speed scan).

The diagram below illustrates an example of the frequency measurement counter operation.



<Principle of Frequency Measurement>

The frequency is calculated using the following equation.

$$f = \frac{N_n - N_{n-1}}{T} \times MULT$$

f : Frequency

N_n, N_{n-1} : Current counter count value of input pulse of every control cycle

T : Time between input pulses (The measurement time minimum unit: 4 MHz = 0.25 μ s)

MULT : Frequency coeffecient (set in the fixed parameter)

The above equation is applicable when more than one pulse is input within a measurement cycle. If no pulse is input within a measurement cycle, the frequency estimated from the previously calculated value is set as the result (f5 in the above diagram), and the true value (f6 in the above diagram) is calculated in the following measurement cycle when pulses are input.

2.4 Counter Functions

2.4.1 Outline of Counter Function

The counter functions are used to write the status and the count value in the input registers according to the counter operation method specified by the counter fixed parameters and output register values.
The following table outlines the CNTR-01 Module counter functions. The counter functions that can be used differ depending on the counter mode.

Function Name		Details	Counter Mode*			Reference
			Reversible	Interval	Frequency Measurement	
PI Latch		Latches the count value at the phase-C signal of DI signal input.	✓			P.35, P.40
Coincidence Output		Outputs a DO signal when the count value agrees with the preset value, and writes the status in the status register.	✓	✓	✓	P.35, P.36 P.41
Coincidence Interrupt		Sends an interrupt signal to the CPU of the Machine Controller when the count value agrees with the preset value.	✓	✓	✓	P.35, P.36 P.41
Mask of Calculation by C-Pulse		Stops counting while the phase-C pulse is being input.	✓			P.32, P.38
Count Disable		Stops counting during the time specified in the output data.	✓	✓		P.35, P.38
Count Preset		Resets the count value to the preset value.	✓			P.35, P.36 P.39
Electronic Gear		Converts the count value into reference units.	✓	✓		P.32, P.44
Ring Counter		Controls cyclicly the count value in the range between 0 to the set value.	✓			P.32, P.43
Multi-purpose Outputs	Zone Output	Outputs a DO signal when the count value is in the zone specified by the upper limit and lower limit, and writes the status in the status register.	✓			P.35, P.36 P.47
	Speed Coincidence	Outputs a DO signal when the feedback speed is in the range specified by the detection value and width, and writes the status in the status register.	✓			P.35, P.36 P.48
	Frequency Coincidence	Outputs a DO signal when the detected frequency is in the range specified by the detection value and width, and writes the status in the status register.			✓	P.35, P.36 P.48

* In the counter mode marked with ✓ , the counter function can be used.

The above functions can be used by setting the fixed parameters (see P.30) and output data (see P.35).

2.4.2 Setting the Counter Fixed Parameters

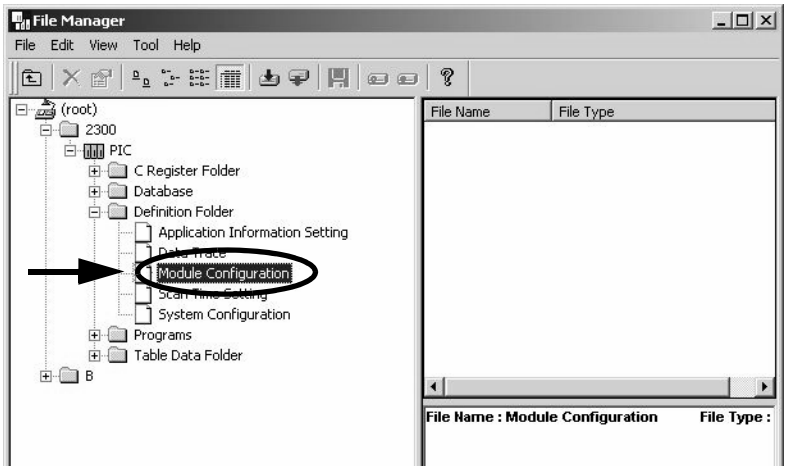
This section describes the procedure to set the counter fixed parameters.

- In this manual, the fixed parameters indicate the counter fixed parameters unless otherwise specified.

(1) Open the Fix Parameter Set Tab Page

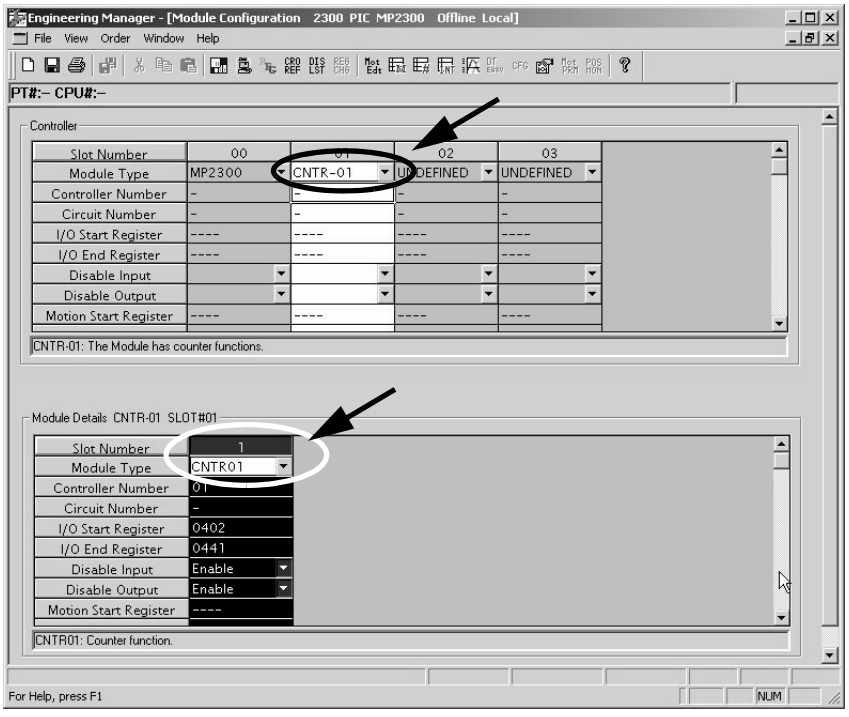
Set the fixed parameters for the counter funcions in the Fixed Parameters Tab Page of the Counter Module Definition Window. Use the following procedure to open the Counter Module Definition Window.

1. Double-click the ***Module Configuration*** under the ***Definition Folder*** in the File Manager Window.



The Engineering Manager will start and the Module Configuration Window will open.

2. Point to ***CNTR-01*** in ***Module Type*** row of the ***Controller*** section of the ***Module Configuration*** Window. Double-click the slot number of the ***CNTR01*** in the ***Module Details*** section.



The Counter Module Definition Window will open.

3. Select the ***Fix Parameter Set*** Tab Page to display the page.

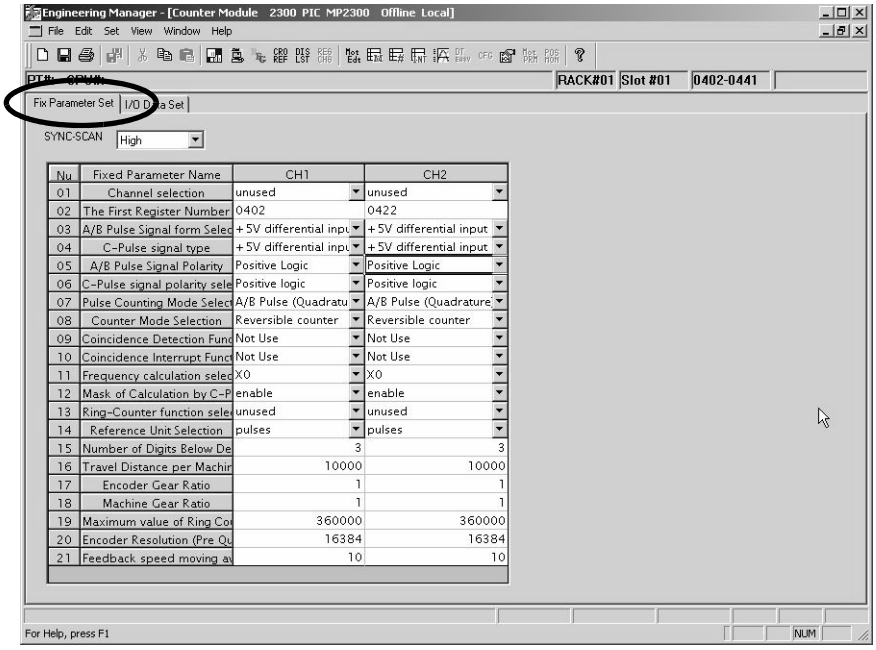


Fig 2.1 *Fix Parameter Set* Tab Page in the Counter Module Definition Window

Set the fixed parameters for each channel in the ***Fix Parameter Set*** Tab Page.

(2) List of Fix Parameter Set

The following table lists the fixed parameters. Refer to the reference page for details .

No.	Name	Counter Mode			Description	Default Value	Ref. Page
		Reversible	Interval	Frequency Measurement			
	SYNC-SCAN	Valid	Valid	Valid	Specify whether the I/O data of counter function is updated in synchronization with High-speed scan or Low-speed scan.	High	—
01	Channel selection	Valid	Valid	Valid	Specify whether to use or not to use the channel. 0: Not use, 1: Use	0: Not use	—
02	The First Register Number	Valid	Valid	Valid	Specify the leading register number to be used for the channel.		—
03	A/B Pulse Signal form Selection	Valid	Valid	Valid	Select the signal form of the phase-A and -B pulses. 0: +5-V differential input, 1: 12-V collector input	0: +5-V differential input	—
04	C-Pulse signal type	Valid	Valid	Valid	Select the signal form of the phase-C pulse. 0: +5-V differential input, 1: 12-V collector input	0: +5-V differential input	—
05	A/B Pulse Signal Polarity	Valid	Valid	Valid	Set the polarity of the phase-A and -B pulses. 0: Positive polarity, 1: Negative polarity	0: Positive polarity	P.38
06	C-Pulse signal polarity selection	Valid	Valid	Valid	Set the polarity of the phase-C pulse. 0: Positive polarity, 1: Negative polarity	0: Positive polarity	—

No.	Name	Counter Mode			Description	Default Value	Ref. Page
		Reversible	Interval	Frequency Measurement			
07	Pulse Counting Mode Selection	Valid	Valid	Valid	Select the pulse counting method from the following seven methods. 0: Sign (×1) 1: Sign (×2) 2: Up/Down (×1) 3: Up/Down (×2) 4: Phase-A/-B pulses (×1) 5: Phase-A/-B pulses (×2) 6: Phase-A/-B pulses (×4)	6: Phase-A/-B pulses (×4)	P.38
08	Counter Mode Selection	Valid	Valid	Valid	Select the counter mode. 0: Reversible counter, 1: Interval counter, 2: Frequency measurement	0: Reversible counter mode	P.26
09	Coincidence Detection Function Use Selection	Valid	Valid	Valid	Set whether to use or not to use the coincidence detection function. 0: Not use, 1: Use	0: Not use	P.41
10	Coincidence Interrupt Function Use Selection	Valid	Valid	Valid	Set whether to use or not to use the coincidence interrupt function. 0: Not use, 1: Use (Valid only when the No. 09: Coincidence Interrupt Function Use Selection is set to 1: Use.)	0: Not use	P.41
11	Frequency calculation selection	Invalid	Invalid	Valid	Set the number of digits of the detected frequency when the fixed parameter No.08 (Counter Mode Selection) is set to 2: Frequency Measurement. The actually detected frequency multiplied by the value set here will be written as the detected frequency. 0: ×1 1: ×10 2: ×100 3: ×1000	0: × 1	—
12	Mask of Calculation by C-Pulse	Valid	Invalid	Invalid	Set whether to prohibit or permit counting while the pulse C is being input. 0: Enabled (prohibits counting), 1: Disabled (permits counting)	1: Disabled*1	P.38
13	Ring-Counter function selection	Valid	Invalid	Invalid	Set whether to use or not to use the ring counter function. 0: Not use, 1: Use	0: Not use	P.43
14	Reference Unit Selection*2	Valid	Valid	Valid	Specify the unit to be used for monitoring. When the unit other than pulse is selected, the electronic gear function can be used. When pulse is selected, the electronic gear function cannot be used. 0: pulse 1: mm 2: deg 3: inch	0: pulse	P.44
15	Number of Digits Below Decimal Point	Valid	Valid	Valid	Set the number of degits to the right of the decimal point for the minimum reference unit in the range between 0 to 5. <Example> If the minimum reference unit is 1 μ m (10^{-3}mm), set the Reference Unit Selection to 3: mm, and Number of Decimal Places to 3	3	—
16	Travel Distance per Machine Rotation (scale pitch)	Valid	Valid	Invalid	Set the load moving amount per load axis rotation in the range between 1 and 2147483647 (reference units).	10000	P.44

No.	Name	Counter Mode			Description	Default Value	Ref. Page
		Reversible	Interval	Frequency Measurement			
17	Encoder Gear Ratio	Valid	Valid	Invalid	Set the value m in the range between 1 and 65535 when the load axis rotates n times while the encoder axis rotates m times.	1	P.44
18	Machine Gear Ratio	Valid	Valid	Invalid	Set the value n in the range between 1 and 65535 when the load axis rotates n times while the encoder axis rotates m times.	1	P.44
19	Maximum value of Ring Counter (POSMAX)	Valid	Invalid	Invalid	When the fixed parameter No. 13 (Ring-Counter function selection) is set to 1: Use, set the position to be reset every turn in the range between 1 and 2147483647 (reference units).	360000	P.43
20	Encoder Resolution (Pre Quadrature)	Valid	Valid	Valid	Set the number of input pulses per encoder rotation in the range between 1 and 2147483647 (pulses/rev).	16384 (Before multiplication)	P.44
21	Feedback speed moving average time constant	Valid	Valid	Invalid	Set the moving average filter time constant to be used to calculate the feedback speed in the range between 0 and 32.	1	–

* 1. With MPE720 Ver.5.33, the default value of Mask of Calculation by C-Pulse is 0: Enabled.

* 2. When the fixed parameter No.14 (Reference Unit Selection) is set to 0: pulse, the settings of No. 16 through 19 are disregarded.

2.4.3 Setting the I/O Data

(1) Opening the I/O Data Set Tab Page

Set the ***I/O Data*** in the ***I/O Data Set*** Tab Page of the Counter Module Definition Window. (Refer to *2.4.2 Setting the Counter Fixed Parameters* on page 30 for information on how to open the Counter Module Definition Window.)

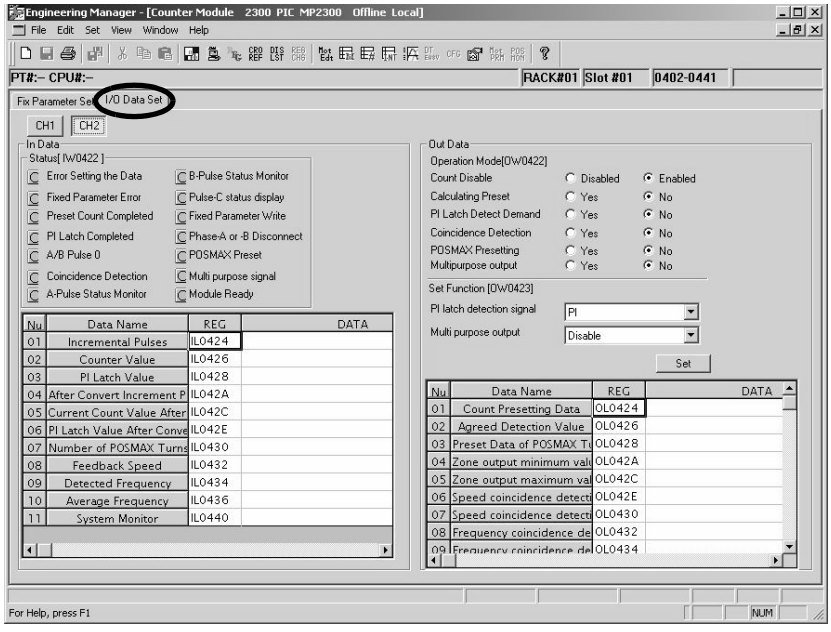


Fig 2.2 I/O Data Set Tab Page in the Counter Module Definition Window

The status to be checked and the I/O data to be specified are explained below.

(2) In Data Items

[a] Status (RUNSTS)

The status of each register bit is displayed in the Status field. " ● " is displayed when the bit is ON while " ○ " is displayed when the bit is OFF. Gray circles are displayed in offline mode.

Name	Bit No.	Meaning	Remarks
Error Setting the Data	0	1 (ON): Data setting error	
Fixed Parameter Error	1	1 (ON): Fixed parameter setting error	
Preset Count Completed	2	1 (ON): Count value preset completed	
PI Latch Completed	3	1 (ON): PI latch completed	
A/B Pulse 0	4	1 (ON): Feedback pulse is ± 1 or less.	
Coincidence Detection	5	1 (ON): Coincidence detection sitnal ON	Detected in pulse units.
A-Pulse Status Monitor	6	1 (ON): High	
B-Pulse Stats Monitor	7	1 (ON): High	
C-Pulse Status Display	8	1 (ON): High	
Fixed Parameter Write	9	1 (ON): Writing a fixed parameter	ON only during write.
Phase-A or -B Disconnect	A	Fixed to 0 (OFF)	For future use
POSMAX Preset	C	1 (ON): Completed	
Multipurpose signal	D	1 (ON): Multi-purpose signal ON	
Module Ready	F	1 (ON): Counter processing being executed	

[b] In Data Details

The following items are displayed in the ***In data*** field.

- The abbreviation of the register name to store the corresponding data is given in parentheses in the Data Name column.

No.	Data Name	Register Number*	Range (Unit)	Counter Mode			Description	Ref. Page
				Reversible	Interval	Frequency Measurement		
00	Status (RUNSTS)	IW□□□□ + 00	Bit setting	Valid	Valid	Valid	Refer to *[a] Status (RUNSTS)*.	—
01	Incremental Pulses (PDV)	IL□□□□ + 02	−2147483648 to 2147483647 (pulse)	Valid	Valid	Valid	Indicates the difference between the pulse count value at the previous scan and that at the current scan.	—
02	Counter Value (PFB)	IL□□□□ + 04	−2147483648 to 2147483647 (pulse)	Valid	Valid	Valid	Indicates the pulse count value every scan.	P.26
03	PI Latch Value (PINT)	IL□□□□ + 06	−2147483648 to 2147483647 (pulse)	Valid	Valid	Invalid	Indicates the current counter count value at the moment an external signal is input.	P.40
04	After Convert Increment Pulse (PDVG)	IL□□□□ + 08	−2147483648 to 2147483647 (reference unit)	Valid	Valid	Valid	Indicates the number of incremental pulses converted into reference units. When the fixed parameter No. 14 (Reference Unit Selection) is set to pulse, the converted value is the same as the number of incremental pulses.	—
05	Current Count Value After Conversion (PINTG)	IL□□□□ + 0A	−2147483648 to 2147483647 (reference unit)	Valid	Valid	Valid	Indicates the current counter count value converted into reference units. When the fixed parameter No. 14 (Reference Unit Selection) is set to pulse, the converted value is the same as the current count value.	—

No.	Data Name	Register Number*	Range (Unit)	Counter Mode			Description	Ref. Page
				Reversible	Interval	Frequency Measurement		
06	PI Latch Value After Converts (FREQG)	IL□□□□ + 0C	-2147483648 to 2147483647 (reference unit)	Valid	Valid	Invalid	Indicates the value of PI latch data/interval data converted into reference units. When the fixed parameter No. 14 (Reference Unit Selection) is set to pulse, the converted value is the same as the PI latch data.	—
07	Number of POSMAX Turns (PMAXTURN)	IL□□□□ + 0E	–2147483648 to 2147483647 (turn)	Valid	Invalid	Invalid	Indicates the number of turns up to the present when the fixed parameter No. 13 (Ring-Counter function selection) is set to be used.	P.43
08	Feedback Speed (FSPD)	IL□□□□ + 10	–2147483648 to 2147483647 (reference unit)	Valid	Valid	Invalid	When the electronic gear function is not used (the fixed parameter No. 14 (Reference Unit Selection) is set to pulse), pulse/sec is used as the unit.	P.47
09	Detected Frequency (FREQ)	IL□□□□ + 12	–2147483648 to 2147483647 (10^{-m} Hz)	Invalid	Invalid	Valid	Indicates the frequency detected at the moment an external signal is input. "m" indicates the set value of the fixed parameter No. 11 (Frequency calculation selection).	P.26
10	Average Frequency (FRQAVE)	IL□□□□ + 14	–2147483648 to 2147483647 (10^{-m} Hz)	Invalid	Invalid	Valid	Indicates the average of the detected frequency values of the number of times specified in the output data No. 10 (Averaging count setting). m indiates the value set in the fixed parameter No. 11 (Frequency calculation selection).	—
11	System Monitor	IL□□□□ + 1E	–2147483648 to 2147483647	Valid	Valid	Valid	For system analysis	—

* □□□□indicates the leading register number.

(3) Out Data Items

Click the ***Set*** Button to output the settings made in the ***Out data*** field.

[a] Operation Mode

Set the following items for the bits 0 to 5 of the Operation Mode (RUNMOD: OW□□□□ + 00).

Name	Bit No.	Description	Counter Mode			Default Value	Ref. Page
			Reversible	Interval	Frequency Measurement		
Count Disable	0	1: Prohibited, 0: Permitted Specify whether to prohibit or permit counting.	Valid	Valid	Invalid	0: Permitted	P.38
Calculating Preset	1	1:Reset, 0: Not reset Specify whether to reset or not to reset the count value to the preset value.	Valid	Invalid	Invalid	0: Not reset	P.39
PI Latch Detect Demand	2	1: Latch, 0: Not latch Specify whether to store or not to store the count value when an external signal is input.	Valid	Valid	Invalid	0: Not latch	P.40
Coincidence Detection	3	1: Output, 0: Not output Specify whether to output or not to output the coincidence detection signal when the counter count value and the coincidence detection set value match.	Valid	Valid	Valid	0: Not output	P.41

Name	Bit No.	Description	Counter Mode			Default Value	Ref. Page
			Reversible	Interval	Frequency Measurement		
POSMAX Presetting	4	1: Reset, 0: Not reset Specify whether to reset or not to reset the number of POSMAX turns to its preset value.	Valid	Invalid	Invalid	0: Not reset	P.43
Multipurpose output	5	1: Detect, 0: Not detect Specify whether to detect or not to detect the multi-purpose output (zone output/speed coincidence/frequency coincidence).	Valid	Invalid	Valid	0: Not detect	P.47

[b] Set Function

Set the following items using the bit 0 to 7 of the Set Function (OW□□□□+01).

Name	Description	Bit No.	Setting	Counter Mode			Default Value	Ref. Page
				Reversible	Interval	Frquency Measurement		
PI latch detection signal	Set the external signal to be used for PI latch.	0 to 3	0: PI (discrete input)	Valid	Invalid	Invalid	0: PI	P.40
			2: Pulse C	Valid	Invalid	Invalid		
Multipurpose output	When the Multi-purpose Output Detection Request is set to 1: Detect, set the output detection method.	4 to 7	0: Invalid	Valid	—	Valid	0: Invalid	—
			1: Zone output	Valid	Invalid	Invalid		P.47
			2: Speed coincidence	Valid	Invalid	Invalid		P.48
			3: Frequency coincidence	Invalid	Invalid	Valid		P.48

[c] Out Data Details

- The abbreviation of the register name to store the corresponsing data is given in the parentheses in the Data Name column.

No.	Data Name	Register Number*	Range (Unit)	Counter Mode			Details	Ref. Page
				Reversible	Interval	Frequency Measurement		
	Operation Mode (RUNMOD)	OW□□□□ + 00	Bit settings	Refer to *[a] Operation Mode* on page 35.				—
	Set Function	OW□□□□ + 01	Bit settings	Refer to *[b] Set Function*.				—
01	Count Presetting Data (PRSDAT)	OL□□□□ + 02	-2147483648 to 2147483647 (reference unit)	Valid	Invalid	Invalid	Set a value to which the current counter count value is reset when the Count Preset Request is executed.	P.39
02	Agreed Detection Value (COINDAT)	OL□□□□ + 04	-2147483648 to 2147483647 (reference unit)	Valid	Valid	Valid	Set the current counter count value to output the coincidence detection signal and output the interrupt signal to the Machine Controller.	P.41
03	Preset Data of POSMAX Turns (TURNPRS)	OL□□□□ + 06	-2147483648 to 2147483647 (turn)	Valid	Invalid	Invalid	Set a value to which the number of POSMAX turns is reset when the POSMAX Turn Number Presetting Demand is executed.	P.43
04	Zone output minimum value	OL□□□□ + 08	-2147483648 to 2147483647 (reference unit)	Valid	Invalid	Invalid	Set the zone lower limit when the Multi-purpose Output Detection Request is set to 1: Detect and the Multi-purpose Output Selection is set to Zone Output.	P.47

No.	Data Name	Register Number*	Range (Unit)	Counter Mode			Details	Ref. Page
				Reversible	Interval	Frequency Measurement		
05	Zone output maximum value	OL□□□□ + 0A	-2147483648 to 2147483647 (reference unit)	Valid	Invalid	Invalid	Set the zone upper limit when the Multi-purpose Output Detection Request is set to 1: Detect and the Multi-purpose Output Selection is set to zone output.	P.47
06	Speed coincidence detection setting	OL□□□□ + 0C	-2147483648 to 2147483647	Valid	Invalid	Invalid	Set the detection speed when the Multi-purpose Output Detection Request is set to 1: Detect and the Multi-purpose Output Selection is set to Speed Coincidence.	P.48
07	Speed coincidence detection width	OL□□□□ + 0E	-2147483648 to 2147483647	Valid	Invalid	Invalid	Set the speed detection width when the Multi-purpose Output Detection Request is set to 1: Detect and the Multi-purpose Output Selection is set to speed coincidence.	P.48
08	Frequency coincidence detection setting	OL□□□□ + 10	0 to 2147483647	Invalid	Invalid	Valid	Set the detection frequency when the Multi-purpose Output Detection Request is set to 1: Detect and the Multi-purpose Output Selection is set to Frequency Coincidence.	P.48
09	Frequency coincidence detection width	OL□□□□ + 12	-2147483648 to 2147483647	Invalid	Invalid	Valid	Set the frequency detection width when the Multi-purpose Output Detection Request is set to 1: Detect and the Multi-purpose Output Selection is set to Frequency Coincidence.	P.48
10	Averaging count setting	OW□□□□ + 14	0 to 255	Invalid	Invalid	Valid	Set the number of times of frequency detection to calculate the input data No. 10 (Average Frequency).	—
11	System Monitor	OW□□□□ + 1E	-2147483648 to 2147483647	Valid	Valid	Valid	For system analysis	—

* □□□□ indicates the leading register number.

2.5 Counter Function Details

This section describes the details on the fixes parameter and input/output data setting items.

- The counter function is valid in the counter mode indicated with **○○** while it is not valid in the counter mode indicated with [○○] .

2.5.1 A/B Pulses Counting Mode **Reversible** **Interval** **Frequency Measurement**

The pulses A and B counting method can be selected by setting the following fixed parameters.

No.	Name	Details	Default Value
05	A/B Pulse Signal Polarity	Set the polarity of phase-A and -B pulse signals: 0: Positive logic, 1: Negative logic	0: Positive logic
07	Pulse Counting Mode Selection	Select the pulse counting method: 0: Sign (× 1) 1: Sign (× 2) 2: Up/Down (× 1) 3: Up/Down (× 2) 4: Pulses A/B (× 1) 5: Pulses A/B (× 2) 6: Pulses A/B (× 4)	6: A/B (× 4)

- For details on the pulse counting methods, refer to *2.2 Pulse Counting Methods* on page 24.

2.5.2 Mask of Calculation by C-Pulse **Reversible** [Interval] [Frequency Measurement]

This function is used to stop counting while the pulse C is being input. This function is enabled by setting the fixed parameter No. 12 (Mask of Calculation by C-Pulse) to 0: Enabled. However, this function is invalid while the PI Latch Detection Demand using the pulse C is ON.
While the pulse counting is being stopped, counting the following values is stopped: Number of Incremental Pulses (PDV; IL□□□□+2), Counter Value (PFB; IL□□□□+4), After Convert Increment Pulse (PDVG; IL□□□□+8), and Current Count Value After Conversion (PFBG: IL□□□□+A)

- An operation example of the Mask of Calculation by C-Pulse is given in *2.3.1 Reversible Counter* on page 26.

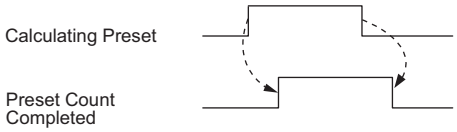
2.5.3 Count Disable **Reversible** **Interval** [Frequency Measurement]

This function stops counting while the bit 0 (Count Disable) of the Operation Mode (OW□□□□+00) of the Setting Output Data is ON.
This function can be used independently from the Mask of Calculation by C-Pulse.
While the pulse counting is being stopped, counting the following values is stopped: Number of Incremental Pulses (PDV; IL□□□□+2), Counter Value (PFB; IL□□□□+4), After Convert Increment Pulse (PDVG; IL□□□□+8), and Current Count Value After Conversion (PFBG: IL□□□□+A)

- An operation example of the Count Prohibit function is given in *2.3.1 Reversible Counter* on page 26.

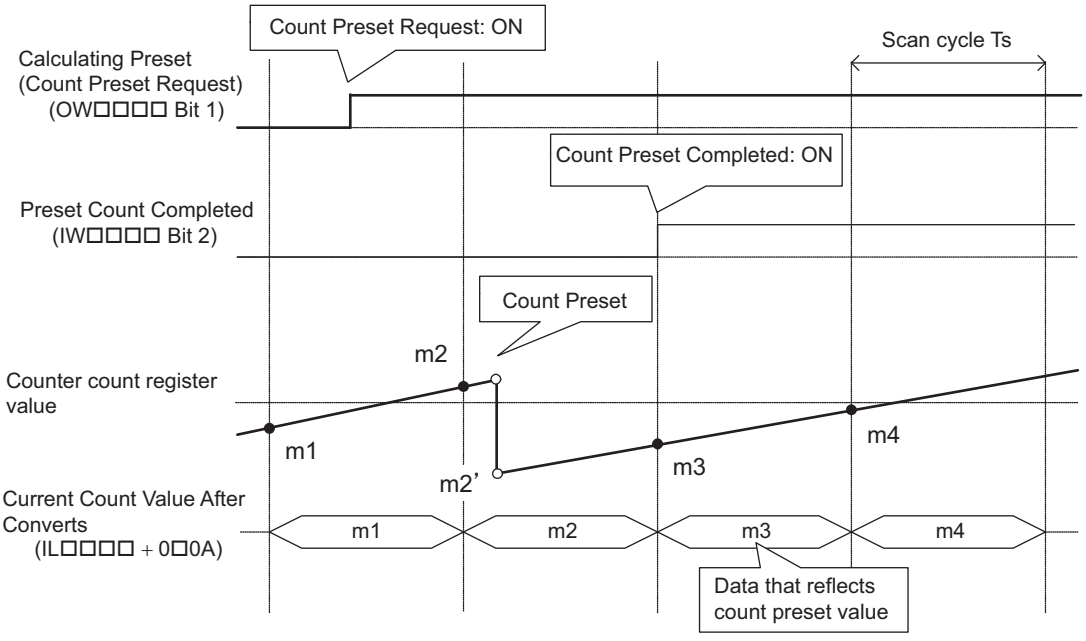
2.5.4 Calculating Preset **Reversible** Interval Frequency Measurement

This function forcibly resets the counter count value to the value specificied in the Count Preset Data (OL□□□□+2). The counter value is reset to the preset value when the the signal of the bit 2 (Calculating Preset) of the Operation Mode OW□□□□+00 of the Setting Output Data is input (detection at the signal rising edge). When the value is reset to the preset value, the bit 2 (Preset Count Completed) of the Status (IW□□□□+00) of the In Data turns ON.

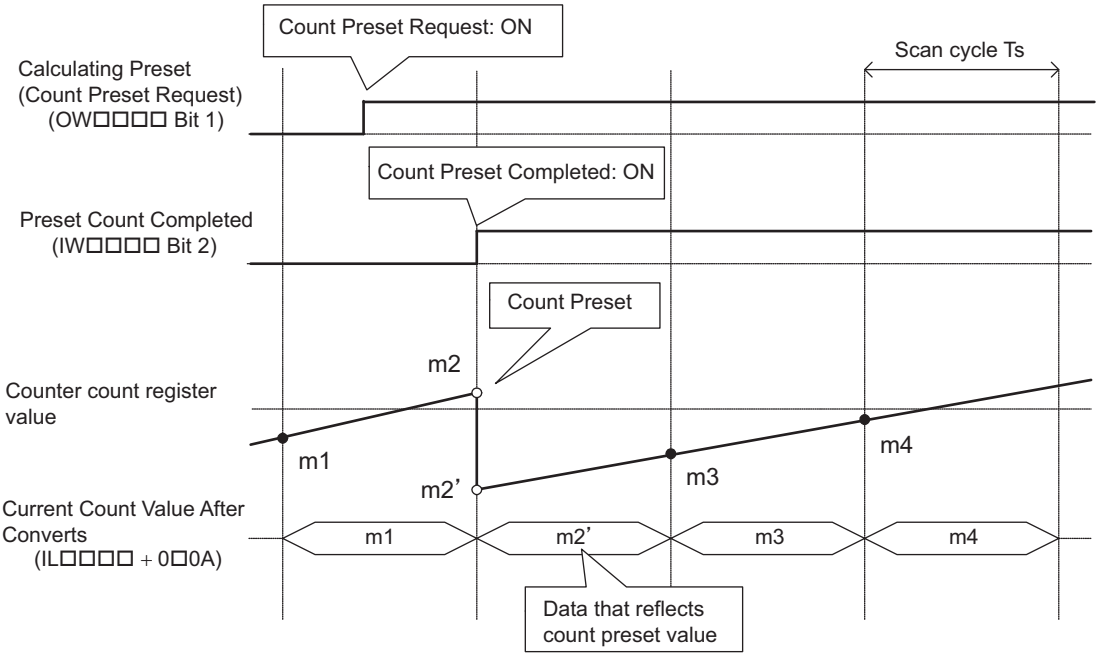


- An operation example of the Calculating Preset function is given in *2.3.1 Reversible Counter* on page 26.
- When using the ring counter function, set the calculating preset data to a value between 0 and the value "POSMAX-1".

The following diagram shows the count preset completion timing of the CNTR-01 Module.

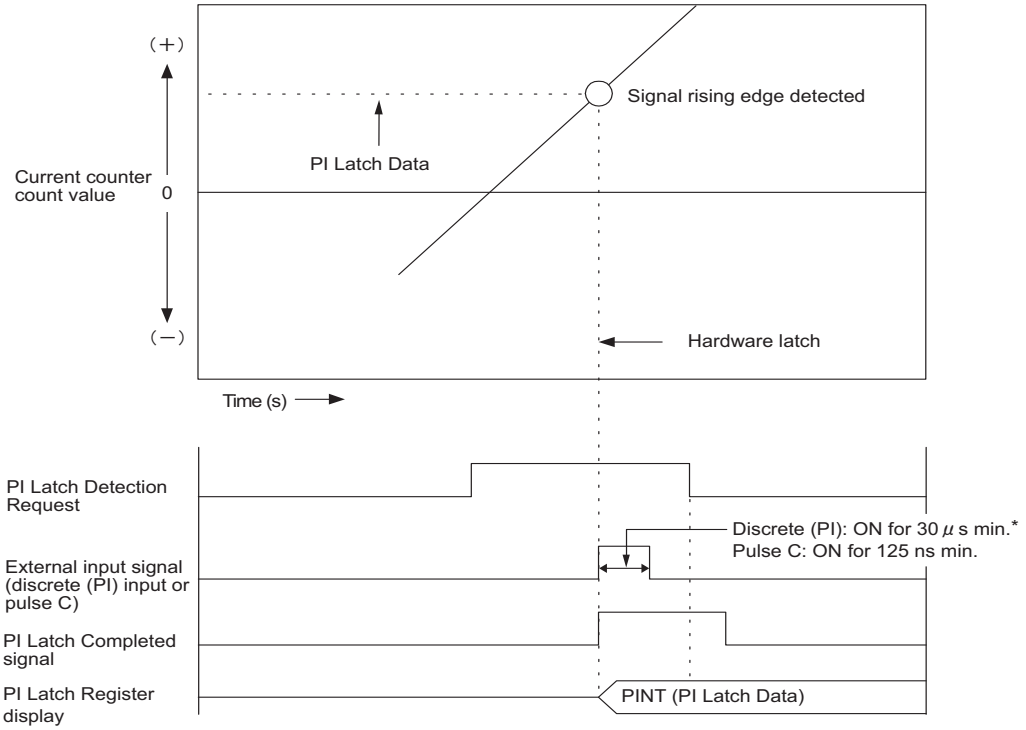


INFO The following diagram shows the count preset completion timing of the LIO-01 Module.



2.5.5 PI Latch **Reversible** Interval Frequency Measurement

This function stores (latches) the counter count value at the moment an external signal is input (at the rising edge detecting point) in the register (IL□□□□+06: PINT) as the PI latch data.
Either a discrete input (PI input) or pulse C can be selected for the external signal to be used.
The following graph shows the PI latch process: Execution of PI latch detection request, detection of the external input signal rising edge, storage of the PI latch data in the register.
When the electronic gear function is enabled (when the fixed parameter No. 14 (Reference Unit Selection) is set to other than pulse), the latch data converted into reference units is written in the input register PI Latch Value After Converts/Interval Data After Conversion.

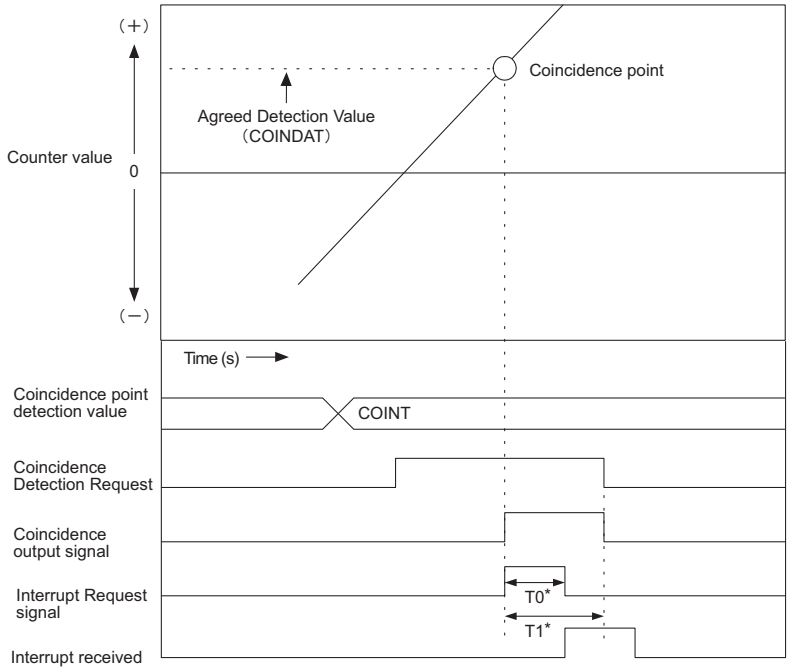


* At least 600 μs must elapse before accepting the ON signal after the signal turns OFF from ON.

2.5.6 Coincidence Output/Coincidence Interrupt **Reversible** **Interval** **Frequency Measurement**

This function outputs the coincidence output signal and outputs an interrupt signal to the Machine Controller when the count value becomes the value predefined in the output register (Agreed Detection Value: OL□□□□+4).
The Coincidence Detection (Operation Mode of Out Data) is enabled when the fixed parameter No. 9 (Coincidence Detection Function Use Selection) is set to 1: Use. And, the Coincidence Interrupt Request is enabled when the fixed parameter No. 10 (Coincidence Interrupt Function Use Selection) is set to 1: Use.

The following graph shows the Coincidence Output/Coincidence Interrupt process: Execution of the coincidence detection request, detection of the coincidence point, and reception of the interrupt.

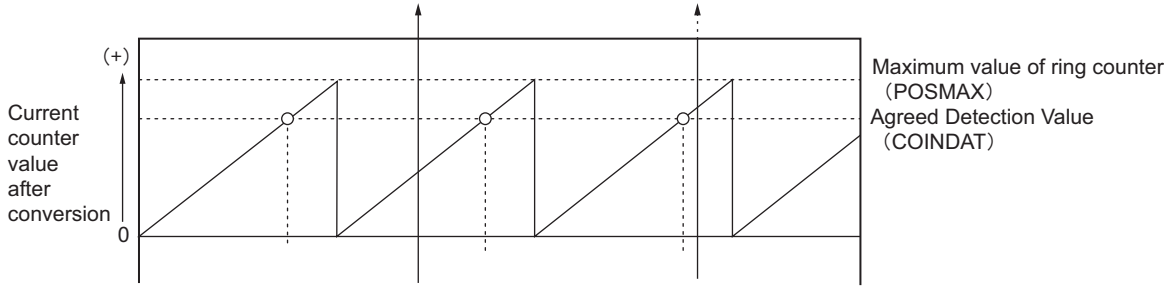


* T0: Maximum time from when the Machine Controller receives an interrupt request signal until it starts interrupt processing (70 to 120 μs)
TI: Time from when an interrupt request signal is received until the DWG.I (interrupt drawing) execution starts

Normal program execution	:	Approx. 90 to 170 μs
Direct I/O command execution	:	Approx. 90 to (1460+40+N) μs (N = No. of direct I/O words (Max. 8))

- Use the Coincidence Detection Signal of the Status to monitor the coincidence detection signal output.

■ Precautions When Using the Ring Counter



When the fixed parameter No. 13 (Ring-Counter function selection) is set to 1: Use, the coincidence detection value exists every cycle as shown in the diagram above. For the coincidence detection processing when the ring counter function is enabled, the coincidence detection set value closest to the current counter count value after conversion is obtained and set every scan. Therefore, if a pulse that exceeds one cycle is input within 1 scan, the coincidence detection may not be executed.

- For details on the ring counter function, refer to *2.5.7 Ring Counter* on page 43.

■ Precautions When Using the Electronic Gear Function

Errors in the result of unit conversion from/to reference unit from/to pulse may cause the following differences in the coincidence detection operation.

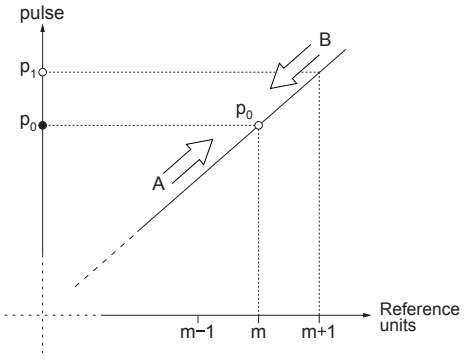
- For details on the electronic gear function, refer to *2.5.9 Electronic Gear Function* on page 44.

● When 1 reference unit = n pulses (n > 1)

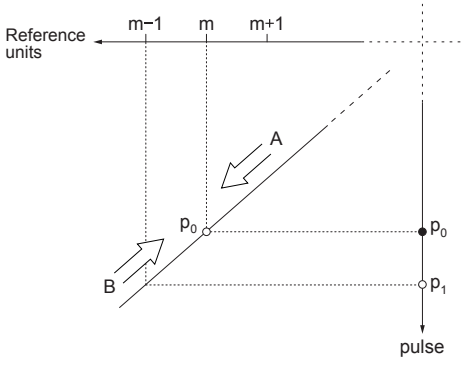
The value p_0 converted from the coincidence detection set value m (reference unit) into pulses is the coincidence detected value. The counter value whose value after conversion is equal to m is p_0 or more but less than p_1. When the pulse to increment the count (in the direction indicated with the arrow A) is input, the CNTR-01 executes coincidence detection at the timing the counter value = m.

When the pulse to decrement the count (in the direction indicated with the arrow B) is input, the current counter value after conversion is equal to m when the counter value = $p_1 - 1$ ($p_1 + 1$ if $p_0 < 0$) . However, the CNTR-01 Module does not execute the coincidence detection at this timing, but executes at the timing the counter value = p_0.

<When p_0 is a positive value>



<When p_0 is a negative value>



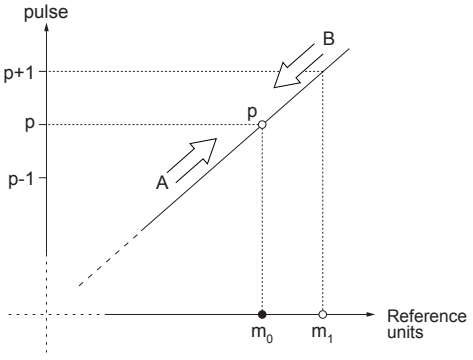
● When 1 pulse = n reference units (n > 1)

The value p converted from the agreed detection value m_0 (reference units) into pulses is the coincidence detected value.

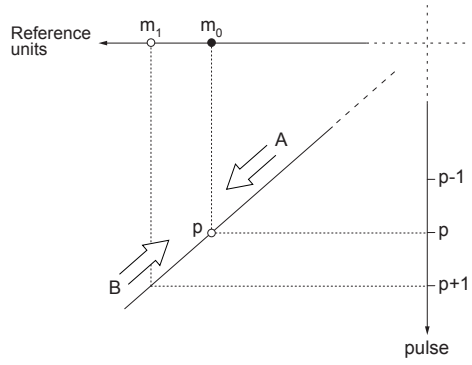
The current counter value after conversion converted from the counter value p is m_0 or more but less than m_1. When the pulse to increment the count (in the direction indicated with the arrow A) is input, the CNTR-01 Module executes coincidence detection at the timing the current count value = m_0.

When the pulse to decrement the count (in the direction indicated with the arrow B) is input, the CNTR-01 Module executes coincidence detection at the timing the current counter value after conversion = $m_1 - 1$ ($m_1 + 1$ if $m_0 < 0$) before the current counter value after conversion becomes m_0.

<When m_0 is a positive value>

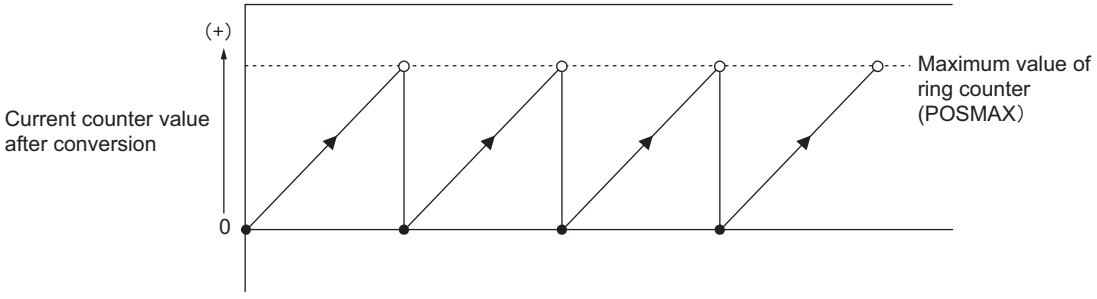


<When m_0 is a negative value>



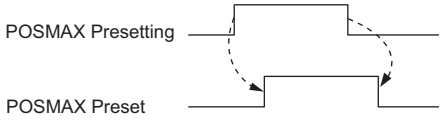
2.5.7 Ring Counter **Reversible** Interval Frequency Measurement

The Ring Counter function cyclicly controls the counter count value to be written in the input register within the range between 0 and the maximum ring counter value (POSMAX). Set the maximum ring counter value in the fixed parameter No. 19 (Maximum value of Ring Counter).
When the fixed parameter No. 13 (Ring-Counter function selection) is set to 1: Use, the value of the input register Number of POSMAX Turns (PMAXTURN: IL□□□□+E) increments by 1 (for forward rotation) or decrements by 1 (for reverse rotation) every time the count value exceeds the ring counter reset position.
This function can be used for the machine configuration to be reset cyclicly without using a special application program.



2.5.8 Number of POSMAX Turns Preset **Reversible** Interval Frequency Measurement

This function forcibly resets the value of Number of POSMAX Turns (PMAXTURN:IL□□□□+E) to the value specified in Preset Data of POSMAX Turns of the Operation Mode (TURNPRS: OL□□□□+6) of the Out Data.
When the value is reset to the preset value, the bit C (POSMAX Turn Number Presetting Completed) of the Status (IW□□□□+00) of the In Data turns ON.

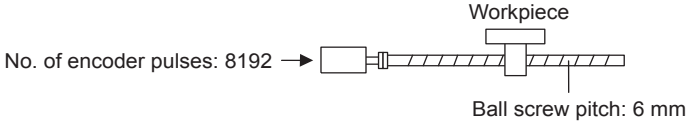


2.5.9 Electronic Gear Function **Reversible** **Interval** **Frequency Measurement**

The Electronic Gear function can be used when other than pulse is set to the fixed parameter No. 14 (Reference Unit Selection).

(1) Outline

The Electronic Gear function is used to set per pulse input to the CNTR-01 Module to any reference unit value.
To calculate the number of required pulses for the system shown below, the operations when using the electronic gear and when not using the electronic gear differ as explained below.



<When the Electronic Gear is Not Used>

If 13653 pulses are input, the number of revolutions is
13653 ÷ 8192 = 1.666 (revolutions)
1 revolution moves the workpiece 6mm, therefore the travel amount by 1666 revolutions is
6 (mm/revolution) × 1.666 (revolutions) = 9.999 (mm)
Therefore, the workpiece moves for 9999 mm by inputting 13653 pulses. This equation must be calculated at the host controller.

<When the Electronic Gear is Used>

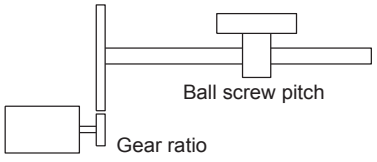
Mechanical conditions such as the moving amount per machine rotation, encoder gear ratio, anc machine gear ratio are predefined and the minimum reference unit is set to 1 μm.
To move the workpiece 10 mm,
10 (mm) ÷ 1 (μm) = 10000 reference units
Input 10000 reference units.

(2) Settings

Use the following procedure to make the settings.

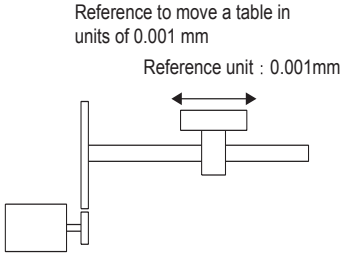
1. Confirm the machine specifications.

Elements relating to the Electronic Gear
- Gear ratio
- Ball screw pitch
- Pully diameter, etc.



2. Confirm the number of encoder pulses displayed in Counter Value, and set this value to the fixed parameter No. 20 (Encoder Resolution (Pre Quadrature)).

3. Set the reference unit (the smallest unit for the reference data to move the load) according to the settings of the fixed parameter No. 14 (Reference Unit Selection) and No. 15 (Number of Digits Below Decimal Point).



Consider the machine specifications and positioning precision when setting the reference unit.

- When reference unit is 1 μm, inputting 50,000 reference pulses moves the workpiece by 50000 × 1 μm = 50 mm.

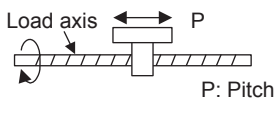
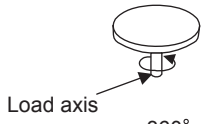
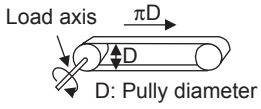
4. Find the load travel distance per load axis rotation using the reference unit, and set to the fixed parameter No. 16 (Travel Distance per Machine Rotation).

$$\text{Travel distance per machine rotation axis (reference unit)} = \frac{\text{Load travel distance per load axis rotation reference unit}}{\text{Reference unit}}$$

<Calculation Example>

For a ball screw pitch of 5 mm and a reference unit is 0.001 mm

$$\frac{5}{0.001} = 5000 \quad \text{(Reference unit)}$$

Ball screw	Round table	Belt + pully
 One rotation $= \frac{P}{\text{Reference unit}}$	 One rotation $= \frac{360^\circ}{\text{Reference unit}}$	 One rotation $= \frac{\pi D}{\text{Reference unit}}$

5. Set the Encoder Gear Ratio and the Machine Gear Ratio in the fixed parameters No. 17 and No. 18.

When the encoder axis has rotated m times and the mechanical configuration allows the load axis to rotate n times, set the following values.

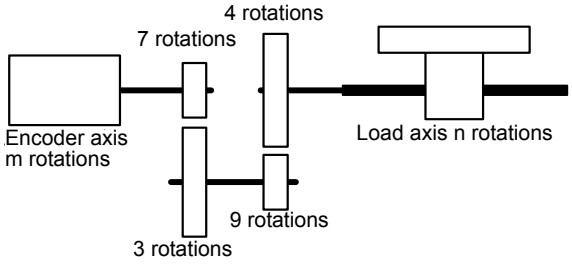
No.17: Encoder Gear Ratio = m (rotations)

No.18: Machine Gear Raio = n (rotations)

(Setting range: 1 to 65,535 (rotations))

<Setting Example>

- For the configuration shown in the diagram



Gear ratio = n / m = (3 / 7) × (4 / 9) = 4 / 21

Therefore, set the following values.

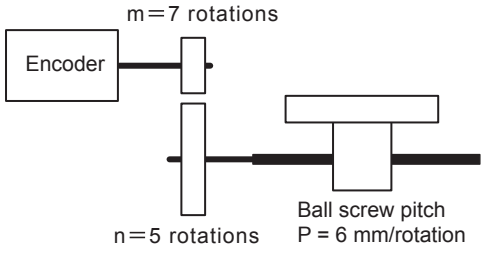
No.17: Encoder Gear Ratio = 4 (rotations)

No.18: Machine Gear Ratio = 21 (rotations)

(3) Setting Examples

The following are setting examples for each kind of load mechnical configuration.

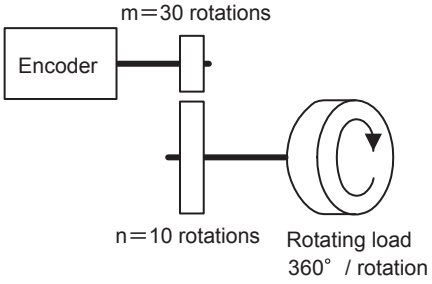
[a] Setting Example for Ball Screw



In the above machine system, if the reference unit = 0.001 mm, the setting of each parameter will be as follows.

- Moving Amount per Machine Rotation = 6mm / 0.001mm = 6000
- No. 17: Encoder Gear Ratio = 7 (rotations)
- No. 18: Machine Gear Ratio = 5 (rotations)

[b] Setting Example for Rotating Load



In the above machine system, if the reference unit = 0.1°, the setting of each parameter will be as follows.

- Moving Amount per Machine Roration = 360° / 0.1° = 3600
- No. 17: Encoder Gear Ratio = 3 (rotations)
- No. 18: Machine Gear Ratio = 1 (rotation)

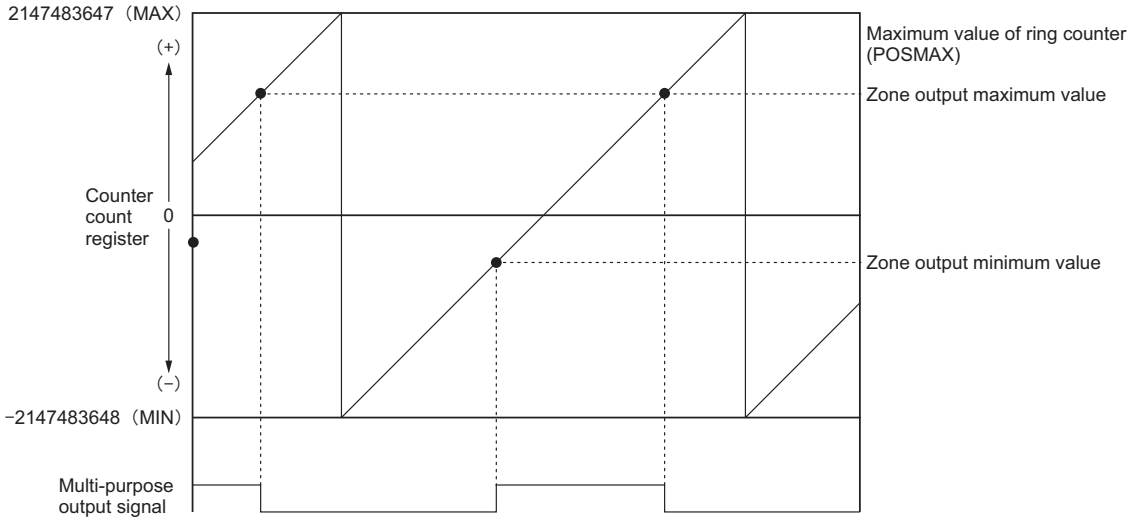
2.5.10 Multipurpose Output Function

The function is used to output the multi-purpose output signal externally when the specified output condition is satisfied and the Multipurpose Output is executed.
The output condition can be selected by setting the output register Multi-purpose Output Selection according to the selected counter mode.
This section describes each output condition.

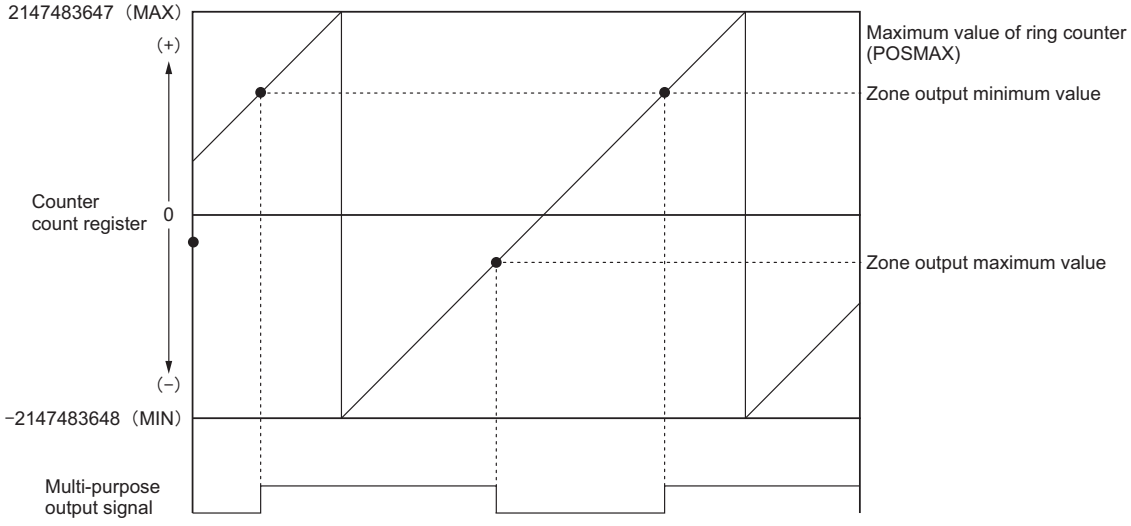
(1) Zone Output **Reversible** Interval Frequency Measurement

The multi-purpose output signal is output at the rising edge of Multi-purpose Detection Request signal when the output register Multipurpose Output is set to 1: Zone Output and the counter value is in the range between the zone output minimum value and the zone output maximum value.
As the counter value is detected by software processing, there will be a delay of maximum 500 μ s .
Operation examples of the Zone Output is illustrated below.

■ When Zone Output Maximum Value < Zone Output Minimum Value



■ When Zone Output Maximum Value > Zone Output Minimum Value



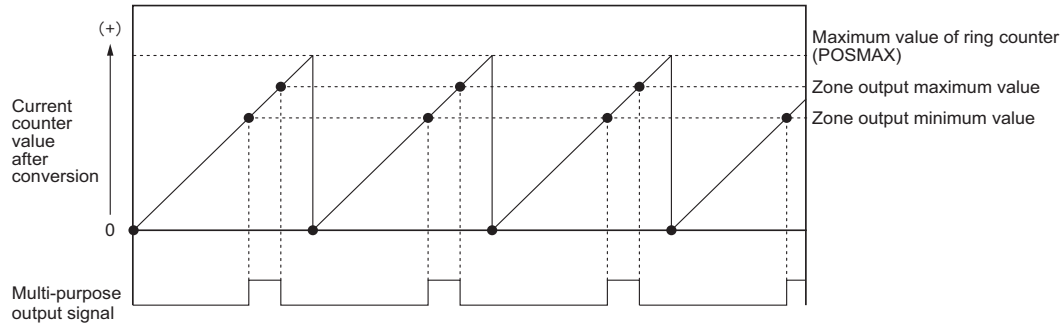
■ When Zone Output Maximum Value = Zone Output Minimum Value

The Multi-purpose Output signal is output when the counter value and the zone output minimum value (= the zone output upper limit) match.

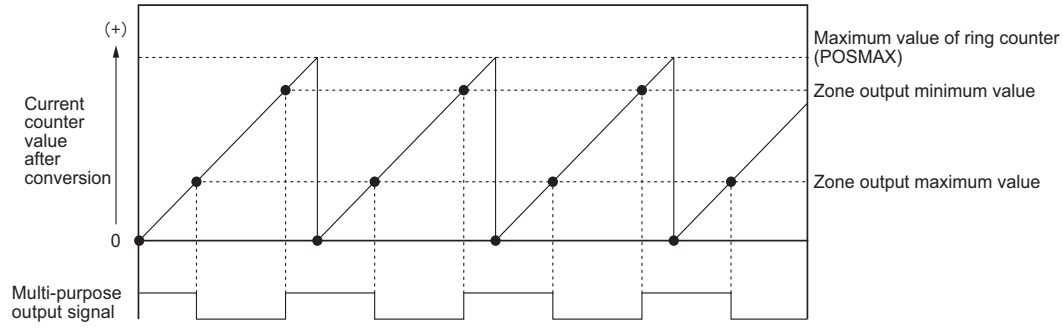
■ Operation When Using the Ring Counter

The zone output operation will be as shown below when the fixed parameter No. 13 (Ring-Counter function selection) is set to 1: Use.

● When Zone Output Minimum Value < Zone Output Maximum Value



● When Zone Output Minimum Value > Zone Output Maximum Value



- For information on the ring counter function, refer to *2.5.7 Ring Counter* on page 43.

---

(2) Speed Coincidence Output **Reversible** Interval **Frequency Measurement**

The multi-purpose output signal is output at the rising edge of Multipurpose Output signal when the output register Multipurpose Output is set to 2: Speed Coincidence and the feedback speed calculated from the difference between the counter values in two control cycles is within the range Speed Coincidence Detection Width whose center point is the set value of the output register Speed Coincidence Detection Setting.

The software processing for detecting the counter count value cause a delay for 500 μ s maximum.

(3) Frequency Coincidence Output Reversible Interval **Frequency Measurement**

The multi-purpose output signal is output at the rising edge of Multipurpose Output signal when the output register Multipurpose Output is set to 3: Frequency Coincidence and the frequency measured by the frequency measurement counter is within the range Speed Coincidence Detection Width whose center point is the set value of the output register Speed Coincidence Detection Setting.

The software processing for detecting the counter count value cause a delay for 500 μ s maximum.

3

CNTR-01 Module Connections

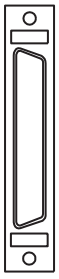
This chapter explains the detailed specifications and functions, connection methods, and settings of the CNTR-01 Module.

3.1 CNTR-01 Module Connections

3.1.1 Specifications on Cable and Connector

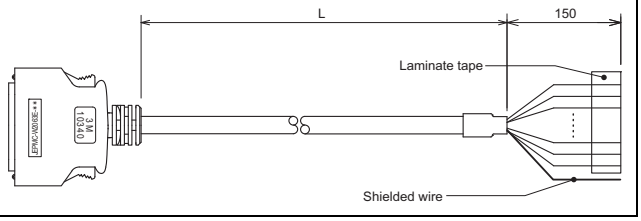
(1) Connector Specifications

Used to connect for the multi-purpose output signals or pulse input signals.



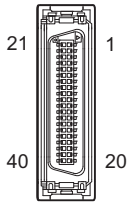
Connector	Connector Name	No. of Pins	Connector Model		
			Module	Cable	Manufacturer
External I/O Connector	CN1	40	10240-52A3PL	・Connector 10140-6000EL ・Shell 10340-3210-006 (One-touch- lock type)	Sumitomo 3M

(2) Connector Models and External Appearance of Standard Cable

Cable	Model	Length	Appearance (JEPMC-W2063-□□-E)
Cable for CNTR-01 Module	JEPMC-W2063-A5-E	0.5 m	
	JEPMC-W2063-01-E	1 m	
	JEPMC-W2063-03-E	3 m	

(3) Standard Cable Wiring

The following table shows thewiring for the JEPMC-W2063-□□-E standard cable loose wire.



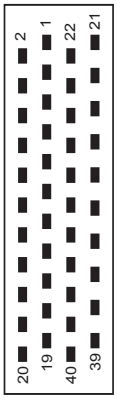
Terminal No.	Dot Mark	Wire Color	Dot Mark	Terminal No.
1	-	Orange	Continuous- - -	21
2	-	Gray	Continuous- - -	22
3	-	White	Continuous- - -	23
4	-	Yellow	Continuous- - -	24
5	-	Pink	Continuous- - -	25
6	- -	Orange	—	26
7	- -	Gray	—	27
8	- -	White	—	28
9	- -	Yellow	—	29
10	- -	Pink	—	30
11	- - -	Orange	— —	31
12	- - -	Gray	— —	32
13	- - -	White	— —	33
14	- - -	Yellow	— —	34
15	- - -	Pink	— —	35
16	- - - -	Orange	— — —	36
17	- - - -	Gray	— — —	37
18	- - - -	White	— — —	38
19	- - - -	Yellow	— — —	39
20	- - - -	Pink	— — —	40
			Shielded wire	Shell

3.1.2 Connector Pin Arrangement

The following table shows the connector (CN1) of the pin arrangement and the terminal layout for the CNTR-01 module.

(1) Pin Arrangement and Terminal Layout

Pin Arrangement at Connection Side



2	+5PB1	1	+5PA1	22	-5PB1	21	-5PA1
4	SG	3	+5PC1	24	SG	23	-5PC1
6	+5PB2	5	+5PA2	26	-5PB2	25	-5PA2
8	—	7	+5PC2	28	—	27	-5PC2
10	12VB1	9	12VA1	30	12PB1	29	12PA1
12	—	11	12/24VC1	32	24PC1	31	12PC1
14	12VB2	13	12VA2	34	12PB2	33	12PA2
16	—	15	12/24VC2	36	24PC2	35	12PC2
18	OUT1	17	COIN1	38	OUT2	37	COIN2
20	PIL1	19	0V (24V)	40	PIL2	39	24V

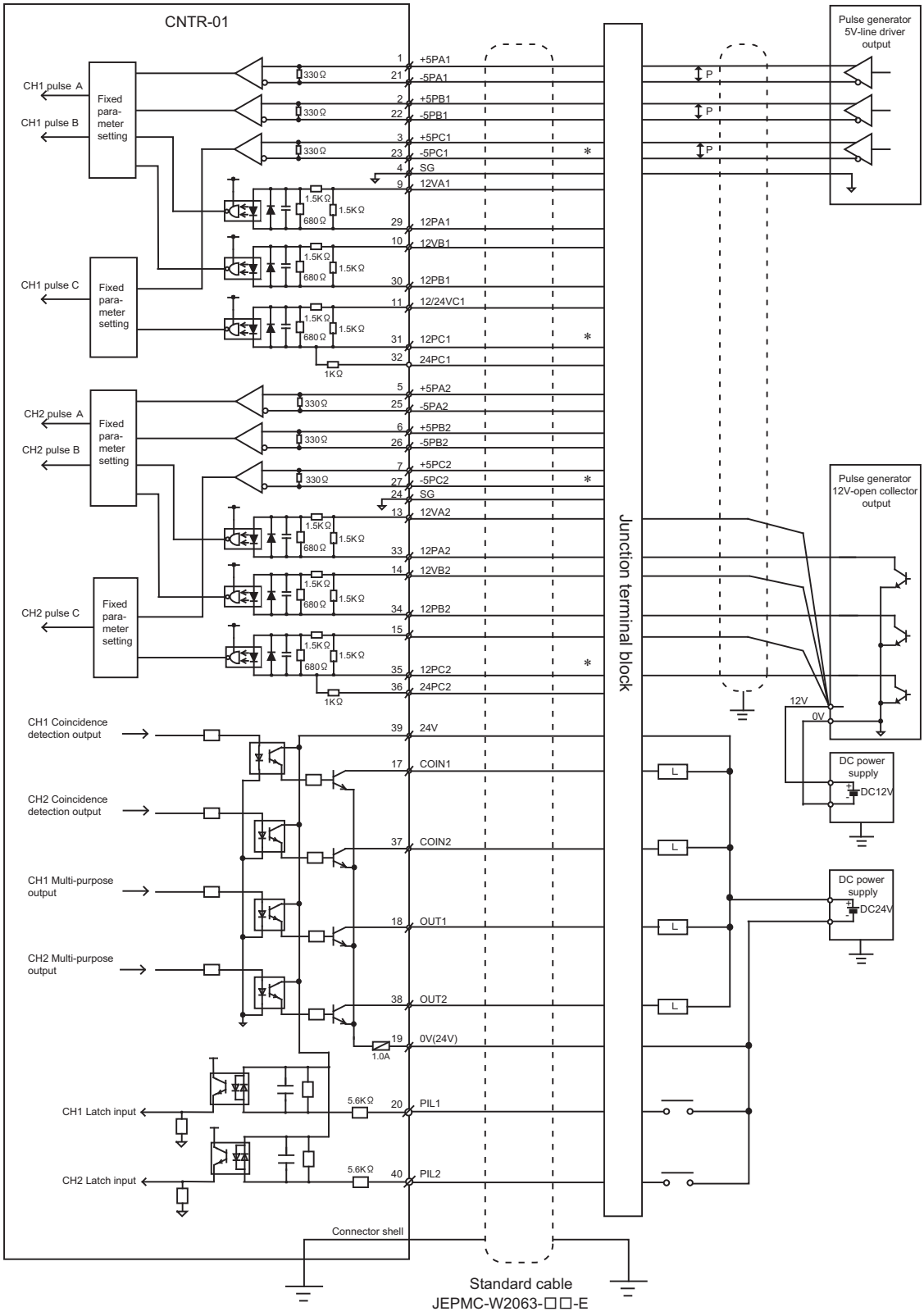
(2) Terminal Specifications

No.	Signal Name	I/O	Function	No.	Signal Name	I/O	Function
1	+5PA1	I	5V differential A1 pulse input (+)	21	-5PA1	I	5V differential A1 pulse input (–)
2	+5PB1	I	5V differential B1 pulse input (+)	22	-5PB1	I	5V differential B1 pulse input (–)
3	+5PC1	I	5V differential C1 pulse input (+)	23	-5PC1	I	5V differential C1 pulse input (–)
4	SG	—	Ground (for pulse input)	24	SG	—	Ground (for pulse input)
5	+5PA2	I	5V differential A2 pulse input (+)	25	-5PA2	I	5V differential A2 pulse input (–)
6	+5PB2	I	5V differential B2 pulse input (+)	26	-5PB2	I	5V differential B2 pulse input (–)
7	+5PC2	I	5V differential C2 pulse input (+)	27	-5PC2	I	5V differential C2 pulse input (–)
8	—	—		28	—	—	
9	12VA1	P	Power supply 12VA1 input	29	12PA1	I	12VA1 pulse input
10	12VB1	P	Power supply 12VB1 input	30	12PB1	I	12VB1 pulse input
11	12/24VC1	P	Power supply 12/24VC1 input	31	12PC1	I	12VC1 pulse input
12	—	—		32	24PC1	I	24VC1 pulse input
13	12VA2	P	Power supply 12VA2 input	33	12PA2	I	12VA2 pulse input
14	12VB2	P	Power supply 12VB2 input	34	12PB2	I	12VB2 pulse input
15	12/24VC2	P	Power supply 12/24VC2 input	35	12PC2	I	12VC2 pulse input
16	—	—		36	24PC2	I	24VC2 pulse input
17	COIN1	O	Coincidence detection output 1	37	COIN2	O	Coincidence detection output 2
18	OUT1	O	Multi-purpose output 1	38	OUT2	O	Multi-purpose output 2
19	0V (24V)	—	Ground (24V) 8	39	24V	P	24V power supply input
20	PIL1	I	Latch input 1	40	PIL2	I	Latch input 2

- P: Power supply input, I: Input signal, O: Open-collector output

3.2 CNTR-01 Connection Example

The following diagram shows the connection example of the CNTR-01.



* If not connecting the phase C with modules, set the fixed parameter No.12 (Counting Mask Using Pulse C) to Disabled.

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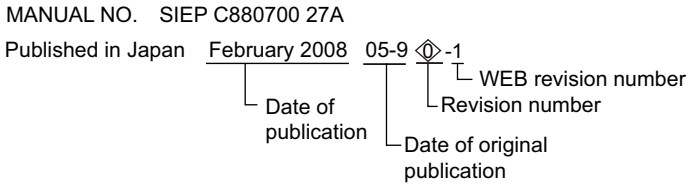
Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.



Date of Publication	Rev. No.	WEB Rev. No.	Section	Revised Contents
May 2010	◇0	5	2.4.2	Revision: Counter mode of feedback speed moving average time constant (no.21)
			2.4.3 (3) [b]	Revision: Bit no.
November 2009		4	3.1.1 (3)	Revision: Dot mark's description, "Sequence number- - -" to "Continuous- - -."
September 2009		3	Preface	Addition: Warranty
			Back cover	Revision: Address
May 2008		2	2.2.3	Revision: The diagrams of down count (reverse) of pulse A/B method (×1)
February 2008		1	All chapters	Slightly revised
			2.1.3 (4)	Addition: CNTR-01 Module status indication
			2.5.4	Addition: Count preset completion timing
			Back cover	Revision: Address
September 2005	−	−	−	First edition

Machine Controller MP2000 Series
Counter Module
CNTR-01 USER'S MANUAL

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